JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

VOLUME 9 DECEMBER, 1941 NUMBER 2

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THERE IS THE RIGHT of a man to stand on his own two feet, and with his own hands and talents carve out a place for himself and his family.

There is the right of a woman to look hopefully ahead, to raise up her brood in dignity and self-respect, undictated to save by her own mother-wisdom and conscience.

There is the right of a boy to lead the hale, free life of boys, flying kites when the wind blows, playing cops and robbers when he wants, going to school when he must—and out of it all somehow shaping a future to a good pattern.

There is the right of a small child to its chance for health and love and laughter, to a good start toward who-knows-what fine and useful life in years to come.

Simple things, aren't they, these things that spell America and add up to freedom!

So simple, so wholesome, it seems daft that somewhere bombs scream down to blast them, tanks lunge to crush them, bullets fly to drive from the minds of men the idea that these *are* their rights, inalienable.

But the bombs do fall, the tanks do roll, the bullets do fly—and in such a world our only shield seems to be more bombs of our own with bombers to carry them, more tanks and the cannon to arm them, more bullets and faster guns to fire them.

So it is that from Goodyear factories meant for building things to enlarge life and make it better, now must flow in a swelling tide the things our country needs if we are to hold what we have.

Skills and facilities developed that a peaceful world might have better tires, floor coverings, soles and heels, transmission belts and a thousand like useful things, now focus on the making of barrage balloons, bomber wings and tails, bullet-puncture-sealing inner tubes and fuel tanks, gas masks, rubber tank track treads and a host of other Goodyear-made defense products.

This is no choice of ours—like yourself, we would far rather spend our days making this a land where life can be richer, liberty enjoyed, where the pursuit of happiness can go steadily on.

But when the decision lies between helping our government prepare for impregnable defense of such things, or running the risk of having them swept away, there is no option and we feel as we know you do.

That which we in America have, we intend to do our part to hold.

Compared with holding it, what else matters?

AMERICA MUST BE FIRST IN THE AIR

Unless and until America is the most powerful nation in the air, our safety, our freedom, and our standard of living will not again be what they have been in the past.

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JOURNAL OF THE AERONAUTICAL SCIENCES

AERONAUTICAL REVIEW SECTION

DECEMBER, 1941

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This lending library service of the Institute makes available, *without charge*, the latest and more important aeronautical books to members of the Institute and others interested in aeronautical progress.

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Condensed Summaries to Appear

IT HAS BEEN REPEATEDLY stressed in these pages that the quantity of aeronautical material being published both here and abroad is constantly growing to such proportions that the time-saving objective of the *Aeronautical Review* becomes increasingly effective in aiding engineers, designers and technicians to keep abreast of developments in their field with as little expenditure of time as possible.

After a year of publication as a separate section of the *Journal of the Aeronautical Sciences*, the *Aeronautical Review* now finds it advisable to even further summarize the significant data from the aeronautical press by providing condensed reviews of developments in specialized aeronautical fields. It is anticipated that these reviews will begin with the January 1942 issue and appear monthly so long as authoritative specialists are able to devote the time necessary to their preparation.

This policy is in line with the editorial "On the Economy of Time" which appeared in these pages last month. This type of contribution will afford the entire industry, even during the emergency, a considerable benefit from the otherwise scattered and uncorrelated material being currently published in multifarious sources on various subjects. Besides aiding to avoid duplication of effort, expense and time-consuming errors, these summaries will furnish a review of the entire scope of developments in each field during the year 1941.

West Coast Library

The extensive demands on the lending services of The Paul Kollsman Library of the Institute of the Aeronautical Sciences have been increasing to such an extent that, with the need for rapid distribution of borrowed material, an increasing urgency for more extensive library services has arisen among aircraft workers on the West Coast. The Pacific Aeronautical Library was established on October 1. The Institute is cooperating in the gathering of a representative collection of aeronautical reference material for use by aviation interests as well as the public in that part of the country.

The Paul Kollsman Fund Committee has authorized a gift from that fund in the amount of $10,000 to be made available to the new library. With this for the purchase of new books in addition to the many duplicates which the Institute library has acquired, the new library will, in a short time, become one of the best sources of current aeronautical information in the United States. The leading aeronautical manufacturers to be served by the libraries have agreed to provide for its upkeep.

The Institute's library has grown in two years to about 18,000 to 20,000 books, pamphlets, and reports. Most of these accessions represent gifts by persons who felt that their libraries would be more useful if combined with larger collections. Inasmuch as any donor may always have access to these books, many members of the Institute have decided that they were rendering valuable services through such donations. It is hoped that similar generosity may be shown to the new Western library so that it will be better able to serve the several hundred thousand aeronautical workers in that district.

Aeronautical Americana

The Library of Congress is preparing a list of all works and pamphlets related to aeronautics which were published in this country before 1800. The list which is being submitted tentatively to several libraries will give information as to where copies of each may be found.

The list, when it is finally completed, will be surprising to many. Of course, everyone knows that before the Civil War there were many balloon ascents, but it is not generally known how much was written about air navigation and mechanical flight. While little that was proposed was found to be practical, it gives evidence that the technically minded men in the United States did more than dream of the possibilities of flight.

The aeronautical archives of the Institute were fortunate in finding in the Bella C. Landauer Collection of books which were added to the library what is undoubtedly the first aeronautical poem written in this country. And it may be the first verse written by anyone envisioning air transport. It was written in the first known pamphlet printed in this country on practical flight. Two of the verses which appear in the Balloon Almanac for 1786 read:

> "Yet more with its fitness for commerce I'm struck
> What loads of tobacco shall fly from Kentuck.
> What packs of best beaver; bar iron, and pig,
> What budgets of leather from Conococheague.
>
> To markets the farmers shall shortly repair
> With their hogs and potatoes, wholesale thro' the air,
> Skim over the water as light as a feather,
> Themselves and their turkies conversing together."

News Review

October 8. E. Burke-Wilford and Hugh S. Cooper announced the first production of workable pieces of beryllium and the alloying of the metal with aluminum. These results represent three years of research directed toward making the forging of beryllium alloys feasible.

October 11. Directors of Lockheed Aircraft Corporation and its subsidiary, the Vega Airplane Company, approved plans for a merger of the two organizations.

October 13. Pan American Airways announced that a staff of 40 men will begin ferrying airplanes to the British in Sudan within a month.

October 14. The Portuguese Government granted Japan the right to operate air service between the islands of Pelew and Deli, Timor.

October 16 U.S. Army engineers tried out their newly developed steel mat-type portable landing fields during maneuvers near Camden, South Carolina.

October 16. Charles Furnas, early assistant to the Wright Brothers and their first air passenger, died at Dayton, Ohio.

October 17. Maj. Gen. George H. Brett, arriving in London after an inspection tour in the Middle East, stated that 100 airplanes a week could be delivered to the British across the South Atlantic.

October 18. The Dutch East Indies airline began service across the South China Sea between Singapore and Kuching, the capital of Sarawak.

October 18. The U.S. Navy entered an experimental order for 14 gliders, including two 24-place units. Four of these will be made of plastic-bonded plywood.

October 23. Maj. Gen. Frank P. Lahm, the U.S. Army's first flyer, succeeded Maj. Gen. G. C. Brandt as commander of the Gulf Coast Training Center.

October 23. The War Department announced the establishment of a Signal Corps procurement district at Wright Field in order to speed up production and delivery of aircraft radio equipment.

October 24. Lockheed Aircraft Corporation and Vega Airplane Company, its subsidiary, set an all-time company employment record for aviation when their payroll passed the mark of 50,000 persons.

October 25. Arthur H. Starnes made a 29,300-ft. free-fall parachute descent at Chicago, carrying 100 lbs. of recording equipment.

October 25. The War Department announced the creation of the title, "The Air Surgeon," and the appointment of Col. David Grant, chief of the Medical Division of the Office of Chief of Air Corps, to fill the new post.

October 31. T. P. Wright, aircraft production expert for the O.P.M., announced the results of a recent survey on aircraft output. It was indicated that the combined U.S.-British production now exceeded that of Germany, Italy and the conquered countries.

The first airport bank in the United States, the Empire Trust Company branch office at LaGuardia Field, New York.

October 28. Capt. C. E. Rosendahl, in a Navy Day address at Miami, declared that, for American coastal defense against submarines, blimps carrying machine guns and depth bombs were the most practical weapons.

October 29. The Office of Civilian Defense announced plans for a nation-wide system of patrol and counter-espionage work to be undertaken by 75,400 private pilots in the U.S.

October 30. Captain Lester Brain flew a Consolidated Catalina patrol bomber from San Diego, California, to Sidney, Australia, via the hitherto unused 2,000-mile route from the Fiji Islands to Sidney.

October 31. The Consolidated B-24 bomber which transported W. Averell Harriman and the aid-to-Russia mission to Moscow last month returned to Bolling Field after a 24,700-mile flight around the world. The four-engined bomber, commanded by Maj. Alva L. Harvey, carried on this flight a crew of six besides the pilot.

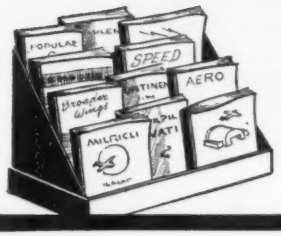
November 3. The first class of pilots graduated from the recently opened Naval air training station at Corpus Christi, Texas, received their commissions. This station will be able to graduate 500 pilots a month by the end of the year.

November 5. Maj. Gen. Lewis H. Brereton arrived in Manila to take command of the Army's first extra-continental air force.

November 6. Transcontinental and Western Air announced a self-imposed censorship on weather information given the general public, pursuant to a request of the Federal Government.

November 6. Maj. Edward Porter, pilot and technician of the U.S. Army Air Forces, was appointed to head a training mission to Bolivia. The mis-

(Continued on page 61)



Periodicals

Accessories

Float Factory. Edward H. Lawson. The general development of float and pontoon equipment for aircraft is outlined in connection with the growth of Edo Aircraft Corporation, which is credited by this writer with the pioneering and present-day popularity of this type of airplane landing gear. The essential characteristics of float design and manufacturing procedure as conducted at the Edo plant are described. Various aviation records achieved by float-equipped aircraft are noted. *Flying and Popular Aviation*, October 1941, pages 18–20, 80, 9 illus.

Design of Airscoops for Aircraft Carburetors. M. J. Kittler. The chief engineer of Holley Carburetor Company's aircraft division reports laboratory investigations undertaken to work out the design of carburetor airscoops so as to insure accurate metering of the carburetor under all conditions. This is said to be of growing importance due to the increasing use of fully automatic carburetors.

Tests were made of a considerable number of airscoops in an effort to determine what factors contributed to the proper or improper functioning of the scoop. It was found that the shape and size of the scoop passages and the location of the hot air valves were important factors. A number of general design criteria were formulated. These are discussed in detail in this paper, along with the ram characteristics under various conditions of flight and for various sizes of scoop.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Review or the Institute of the Aeronautical Sciences.

An actual production model of airscoop was designed in which these various features were included. The aerodynamic and structural features of this airscoop are discussed and explained in detail. Five simple rules are given to assist the designer in laying out an airscoop which will incorporate the design features found to be desirable. *S.A.E. Journal*, November 1941, pages 501–508, 12 illus.

Stick Forces. Description of an instrument for determining the force required to operate the control column. It consists of a spring held between two collars, one of which is free to slide, and of a slider on a fixed rod, moved along the rod by the pressure of the collar. When the load on the spring is released the slider remains at the maximum position, which can be read afterwards. The rod is graduated in inches, but may be graduated in pounds if desirable.

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Flight, September 11, 1941, page 161, 2 illus.

Self-Sealing Tanks. A study of the construction and fabrication of the British Henderson crashproof tank which is being fitted to the Miles Master trainer. This type tank is built of Hencorite, a semi-plastic rubber compound which is placed between thin layers of tinned copper, making a metal-to-metal bond possible. The article describes how the parts are stamped and assembled, and the vulcanizing and testing process used which are exclusive to this company. *Aircraft Production*, October 1941, pages 343–346, 11 illus.

Aerodynamics

Aerodynamics Condensed. Raoul J. Hoffman. A brief presentation of the elements and nature of the study of aerodynamics. The concise, simple text is supported by a group of 15 drawings illustrating the basic aerodynamic principles described. *Flying and Popular Aviation*, October 1941, pages 55, 84, 15 illus.

Air Policy

Aviation's Traveling Salesmen. Charles W. Schlipf. A lecture at the Franklin Institute in Philadelphia four years ago presented 39 demonstrations illustrating the principles of flight. Enthusiasm over the presentation led to a travelling unit which has since presented avaition's story to more than 250,000 people. The nature of the show, known as "From

Magic Carpet to Rocket Ships," its objectives and results are reported in this article. *Flying and Popular Aviation*, October 1941, pages 29, 30, 3 illus.

The Air Force and the Army. Accounting for the formation of the Army Cooperation Command, this article explains the necessity for air observers and reconnaissance crews being trained in military tactics. When this fact became evident in the years following the Armistice, a number of R.A.F. squadrons was permanently allocated to act under the operational control of Army commanders.

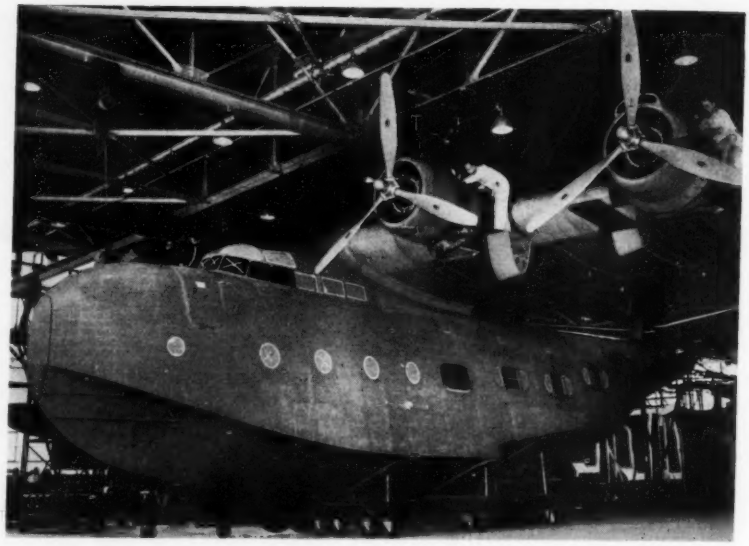
Officers of these squadrons were put through a thorough course at a School of Army Cooperation. In these squadrons, the same man acted as pilot and observer. Army officers were early allowed to be seconded into these squadrons, so that the proportion now is about half-and-half Army and R.A.F. men. The work of the squadrons is explained.

The evacuation of the B.E.F. and the R.A.F. from France revealed improvisation and experimental organization. Preserving independence of the R.A.F., the Air Ministry then agreed with the War Office on the formation in the R.A.F. of the Army Cooperation Command. Its object is to ensure that the Army and the Air Force thoroughly understand each other, the latter to have a full comprehension of the Army's objects, methods and requirements, and the Army to understand how far the air can help it in achieving its objectives.

The organization of the Cooperation Command is described, with notes of comparison to the similar function of units in the German *Luftwaffe*. The equipment used and the operations of the Cooperation Command are outlined. *Indian Aviation*, June 1941, pages 147, 148, 150, 151.

Should We Learn From the Germans? Frank C. Osmers, Jr. An air-minded Congressman from New Jersey discusses his views on the relationship between Army and Navy air forces in the light of the experience of World War II. His opinions converge in an idea for the creation of a general war college to coordinate the now separate air forces. *Flying and Popular Aviation*, October 1941, pages 23, 78, 1 illus.

A Hemisphere Defense Plan. "Daedulus." A general article in which the writer discusses our Latin-American relations and the defense problem of the Americas, suggesting that the United States demonstrate its good neighborliness by working closely with Latin and South American army and navy air forces. *Flying and Popular Aviation*, October 1941, pages 48–50, 92, 3 illus.



The first of three 4-engined flying boats built for American Export Airlines' proposed non-stop transatlantic service nears completion at the Vought-Sikorsky Aircraft Division plant, Stratford, Connecticut.

Wings for the Americas. Alfredo de los Rios. An account of the objectives and activity of the Civil Air Mission of the Inter-American Escadrille, with notes on the status of civil aviation in Latin America. *Air Youth Horizons*, November 1941, pages 3, 4, 23, 3 illus.

Air Power

Japan's Air Power. Victor L. Gruberg. An estimate of Japanese air power in the light of geographical considerations, Japan's known air strength, evidence from her operations in China and data on Japan's economic and material resources. These factors are reviewed and discussed with the conclusion that, however efficient Japan's aircraft types and aircraft production may become, the weak foundations upon which such efforts are based place Japan's air power potentially far behind that of the United States, the Soviet Union or any major European power. *The Aeroplane*, August 15, 1941, pages 174, 175, 3 illus.

Japan's Strength in the Air. Charts analyzing Japan's sources of strategic raw materials and the strength of her air forces. A map is included to show geographical relationship of Japan to opposing air power of the United States at Guam and Manila and Britain at Singapore. *The Aeroplane*, August 29, 1941, page 225, 3 illus.

The Russian Air Force. James L. H. Peck. This article describes the organization of the Soviet air force and reports details on some of the airplanes being used by Russia in the present conflict with Germany. Comparison of some of the German and Russian equipment is made. *Flying and Popular Aviation*, October 1941, pages 14–17, 62, 64, 11 illus.

Air Force of 400,000 to Be Uncle Sam's Answer to Hitlerism. Maj. Frank L. Nelson. A report on the status of this country's pilot training program and its meaning to the future of United States' air power. The nature of the training routine is outlined. *U.S. Air Services*, November 1941, pages 17, 20, 1 illus.

Air Safety

Beware of Propellers! Dwight Swain. An analysis of the Civil Aeronautics Board Safety Bureau's report on propeller accidents. Causes of such accidents are noted along with cautions for safety. *Flying and Popular Aviation*, October 1941, pages 27, 28, 106, 1 illus.

Are You Forced Landing Conscious? John R. Hoyt. A study of forced landing crash reports of the Civil Aeronautics Board's Safety Bureau. The 41 crashes reported in 1940 are analyzed and the proper technique is explained for preventing crashes in forced landing practice. *Flying and Popular Aviation*, October 1941, pages 37, 38, 98, 3 illus.

Air Transport

Design for Air Passengers—on the Ground. Marguerite Welch. A description of United Air Lines' chain of new traffic offices, with notes on the

manner in which they were designed to attract a greater volume of air traffic. *Airlanes*, September 1941, pages 6, 7, 17, 6 illus.

Magna Charta Chapter Two. Bill Mitcham. A come-back report of what happened when an *Air Facts* article on how to operate a triangular-route charter service worked on the mind of Henry K. Gilbert, Jr. Two months after reading the article, he was moved to try the idea and started State Airlines, Inc., operating two 90 hp. Bellanca airplanes between Charleston, Columbia and Charlotte in the Carolinas on a "leave anytime" slogan. The two passenger-and-pilot airplanes have shown a profit on the 170-mile circuit and have averaged a revenue of $9.45 from each passenger carried, charging six cents a mile, just as the scheduled airlines. *Air Facts*, November 1941, pages 23–26, 1 illus.

Ocean Flying Is Routine. Juan T. Trippe. An adaptation of the writer's address before the Royal Aeronautical Society in London last June, this article outlines the organization and conduct of Pan American Airways' operations on the transatlantic route. *Flying and Popular Aviation*, October 1941, pages 44–46, 58, 60, 100, 5 illus.

Airplane Descriptions

The High-Flying Fortress. A description of the Boeing 17-C Fortress as seen by press representatives on an official inspection of one of the craft now reaching England in a steady stream. The account is confined largely to interior arrangement and general impressions of the craft as a whole. *The Aeroplane*, August 22, 1941, pages 198, 199, 4 illus.

Better U.S. Boats and Bombers. J. I. Waddington. A review of the latest Lease-Lend types of American military airplanes reaching Britain. A number of improvements are noted, and features of the Boeing Fortress, Consolidated Liberator and Martin Maryland are described along with other new versions of earlier models. *Flight*, July 31, 1941, pages 62f–62h, 63, 5 illus.

The ME 109 Fl/2. A report of an engineering inspection of the latest version of the Messerschmitt 109 fighter. It is said to reveal that the fire power has been reduced below that of the Me 109's "routed from the battle sky of 1940." The fuselage bulkhead has been moved from behind the petrol tank to a position between the tank and the pilot. The tank now consists of a flexible bag enclosed in and supported by a plywood box. Ceiling is believed to be 41,000 ft.

The tailplane has been altered to a cantilever type, but is still adjustable. Wing tips have been rounded and the proportions of flaps, ailerons and slots have been altered. An unusual feature is the design of the radiator. There is one under each wing sunk deeply into the wing. Flow is controlled by two hydraulically operated exit flaps. *Flight*, July 31, 1941, page 62, 2 illus.; also *The Aeroplane*, August 1, 1941, pages 120, 122, 5 illus.

Bristol Beaufighter. Extensive details on the design and operational equipment of the twin-engine night fighter version of the Bristol Beaufort. Top speed is given as 330 m.p.h. at 14,000 ft.; range is 1,500 miles at a cruising speed of 200 m.p.h.; service ceiling is 28,900 ft. Principal dimensions and other performance figures are also given.

The armament is said to be very heavy. Four 20 mm. shell-guns are carried in the floor of the fuselage and six machine-guns of rifle calibre are remotely controlled in the wings. Provision is made for a power-operated turret amidships. *Flight*, August 14, 1941, pages 90–90d, 14 illus. Also *The Aeroplane*, August 8, 1941, pages 139, 140, 4 illus., and August 22, 1941, pages 208, 209, 7 illus.

Interstate Cadet. Considerable detail on the flying characteristics and handling of the Interstate Cadet light airplane is given in this account of a flight by the writer. Design details are noted particularly in so far as they influence flying characteristics described. Performance and specifications are not given. *Air Facts*, November 1941, pages 27–34, 5 illus.

Langley Bi-Motor. A description of the general characteristics, specifications and performance of the molded plywood twin-engined airplane recently developed by Langley Aviation Corp. *Air Facts*, November 1941, pages 46–49, 5 illus.

Taylorcraft Tandem. Discussion of the performance and flying characteristics of the new Taylorcraft tandem trainer. *Air Facts*, October, 1941, pages 18–24, 3 illus.

Aviones de Escuela Alemanes (German Training Planes). The rapid formation of the *Luftwaffe* is attributed in this article to the fact that it had excellent training planes at its disposal. Among the most efficient of this type are those of the Arado Airplane Works. In 1932 they manufactured the Ar 66. At the present time they manufacture the all-metal training plane Ar 96. *Avia*, September 1941, pages 185, 186, 2 illus.

Northrop's Flying Wing. A description of the recently announced Northrop Flying Wing, a type of aircraft all of whose parts are installed within the contour of the wing, all of which, with the exception of the propeller drive shafts, contributes directly to the lift obtained. The article also outlines the history of the flying wing and projects the designs of aircraft which may be developed from it in the future. *Aero Digest*, November 1941, pages 116, 118, 121, 5 illus.

They Make Their Bow. The revised version of the Piper Cruiser and the new Langley twin-engined monoplane are described. The former has been altered to provide greater comfort and better appearance. The latter is built exclusively of molded plywood, metal being used only in the standard fittings. *The Sportsman Pilot*, October 15, 1941, pages 28, 40, 3 illus.

La Marina de los Estados Unidos de America Recibe el Primero de los Nuevos Curtis SNC-1 Para Entrenamiento Avanzado de los "Pilotos de Combate" (The U.S. Navy gets the first of the new Curtiss SNC-1's for the advanced training of combat flyers). A somewhat detailed description of the design and structural features of the Curtiss SNC-1. *Avia*, September 1941, pages 179, 180, 4 illus.

The Twin-Engined 4-Place "Langley." Description and structural details of the four-place low-wing Langley, powered by two 65 hp. Franklin engines. The entire structure of this airplane, including the cowlings is built of mahogany plywood fused together with a plastic that responds to heat and pressure. *Aero Digest*, November 1941, page 143, 4 illus.

Aeronca 1942 "Defender." Description of the 1942 model of the Aeronca trainer, equipped with a variety of 65 hp. engines. The changes include a new type muffler, improved control system, roomier cockpit, oleo landing gear and Standard brakes. *Aero Digest*, November 1941, page 176, 1 illus.

Short "Stirling" Bomber. Description of the Short *Stirling* four-engined bomber, powered by either Bristol Hercules or Wright Cyclone twin-row 1,400 hp. engines. *Aero Digest*, November 1941, page 180, 2 illus.

Curtiss AT-9. Description of the new type twin-engined trainer built for the Army's program for training pilots in twin-engined equipment for high speed bombing missions. The trainer is a low-wing monoplane,

powered by 280 hp. Lycoming engines, fully retractable landing gear, and carries two passengers in addition to the crew of two. *Aero Digest*, November 1941, page 176, 1 illus.

Halifax. A very general description of the new Handley Page four-engined bomber, said to carry formidable offensive and defensive armament. *Flight*, September 18, 1941, pages 173–175, 9 illus.; also *The Aeroplane*, September 19, 1941, pages 306, 307, 7 illus.

H.A. 138. A summary description of general characteristics of the new Blohm and Voss Ha 138 naval reconnaissance flying-boat. It has three Junkers-Diesel engines, the center one being above the hull and of greater power with a four-bladed propeller while the outboard engines have three-bladed propellers. Armament is said to include shell and machine guns, two gun positions astern and a power-operated turret on the prow. Performance figures are not available, but the airplane is reputed to have quite a useful range and speed. *Flight*, September 4, 1941, page 131, 3 illus.

"The Eye in the Sky." The German appellation for the unorthodox Focke-Wulf FW 189 reconnaissance monoplane is derived from the excellent visibility provided by the design, as this brief general description indicates. *Flight*, October 2, 1941, page 221, 2 illus.

Botha in Pictures. A series of both ground and flight photographs of the Blackburn Botha, a Coastal Command operational training aircraft, shows close-ups of both exterior and interior details and views of the craft in various flight attitudes. *Flight*, October 2, 1941, pages 214a–214d, 18 illus.

German Aeroplanes in Service. I–VII. Weekly columns containing drawings and descriptions of the types of German aircraft now in service. Intended as a useful guide to German aeronautical design, the column presents available data on the type, crew, armament, dimensions, weights and performance of each airplane. *The Aeroplane*, September 5, 1941, pages 250, 251, 12 illus.; September 12, 1941, page 276, 6 illus.; September 19, 1941, page 313, 6 illus.; September 26, 1941, page 333, 6 illus.; October 3, 1941, page 363, 6 illus.; October 10, 1941, page 403, 5 illus.

Bristol Fighters—Their Increase in Striking Power. Comparative data on Bristol fighters from 1914 to 1941. Tabular information shows the type, year of inception, size of crew, engine horsepower, armament, maximum speed, initial climb and service ceiling. *The Aeroplane*, September 12, 1941, pages 280, 281, 9 illus.

Airports

Aerodrome Levelling. Jack Olding and Company, Ltd., a pioneer British firm in the manufacture of caterpillar tractors, has set up schools in various parts of England to train Service recruits in the uses and maintenance of tractors for airport construction. The training and the use of tractors for grading are described. *Flight*, October 9, 1941, pages 234c, 234d, 7 illus.

We Pilots Want Service! Edward Churchill. A private airplane owner recounts his difficulties with the hangar and servicing facilities in most sections of the country. He finds them usually "far from satisfactory" and offers constructive criticism on the subject. *Flying and Popular Aviation*, October 1941, pages 21, 22, 88, 2 illus.

Aerodromes for War Flying. Louis T. H. Greig. The problem of providing an adequate number of improved airports in England for wartime military needs has emphasized the necessity for replanning now for the future and for the development that must come with peacetime, according to this writer. He analyzes the shortage of landing grounds in England and the improvements wanted in present airports, such as contact lighting of runways, tower control by two-way radio communication with airplanes within the airport control area, etc. *Indian Aviation*, May 1941, pages 118, 119.

New Runways by Soil-Cement. An explanation of the characteristics and methods for using soil-cement, the new material for building airport runways. Construction of runways by this method at the plant of Brewster Aeronautical Corporation is described. *Aviation*, November 1941, pages 69, 70, 6 illus.

Brewster Airport. James Work. The Chairman of Brewster Aeronautical Corporation gives a comprehensive description of the building of his company's new airport adjoining their factory in Bucks County, Pa. The newly developed soil-cement system which processes a mixture of local soil with Portland cement was used in this project and, having been completed, is expected to last ten years without ordinary maintenance. *Aero Digest*, November 1941, pages 69, 70, 72, 74, 10 illus.

Avigation

Flight Computers. Lieut. T. C. Gillmer. An explanation of the construction, function and usage of flight computers as applied to problems of avigation. General features of similarity are noted without details on specific types of calculator. *Flying and Popular Aviation*, October 1941, pages 39, 40, 74, 10 illus.

Eenvoudige Navigatie ten dienste van de Sportvliegers (Simple Navigation for Sports Flyers). J. W. Verhoeven. The tenth in a series of articles, this installment treats of dead reckoning, triangle of velocities, determination of course and ground speed, determination of wind from drift observations, determination of radius of action and determination of relative wind. *Luchtvaart*, September 9, 1941, pages 339–340, 342, 8 illus.

What About Drift? Warren C. Youngclaus. A study of drift and its effect on accurate avigation, and the use and application of common types of drift indicators to the problem of proper allowance for drift in flight.

The conventional floor-type and the Gatty drift indicator are explained and their application in the true heading-true course method is outlined. *Aero Digest*, November 1941, pages 52, 54, 179, 7 illus.

Civil Air Defense

Organizing for Civil Air Defense. An outline of the plans for organization being followed by various states in setting up civil air defense units. The nature of services to be performed by such units and the means established for regulating their operations are described. *National Aeronautics*, October 1941, pages 12–14, 2 illus.

Osoaviakhim, Civil Air Defense in Russia. Lucien Zacharoff. An account of the peacetime training of Russia's civilians for advanced military tactics never used until the present World War. Even farmers have been trained in the use of gliders and parachutes and in repelling invasion by such methods. Blackouts have been practiced since 1935, and fire brigades and civilians alike have long been trained in the quenching of incendiary bombs.

The system of training by which this preparedness was accomplished is explained. The heart of it has been the Osoaviakhim, abbreviation for an organization called The Society for Aid in Defense and Aviation-Chemical Upbuilding of the U.S.S.R. It has embraced all classes of civilians, scientists, clerks, factory workers and farmers as members of study groups attached to their places of employment. The Society pays for training literature and maintains hundreds of aero clubs, paying for the aircraft and gliders used. It also sponsors model building. *National Aeronautics*, October 1941, pages 10, 11.

Design

Forecasting the Post-War Private Airplane. Al Mooney. With a preamble describing the development of private airplane types since the last war, the chief engineer of Culver Aircraft Corporation sets down his views of the probable design features of private airplane types to be developed after this war for buyers of moderate means. His prediction of predominating types includes the two-place side-by-side type, with the four-place family airplane with sedan arrangement gaining favor. Speed with safety, he says, will be the design keynote.

It is suggested that aerodynamic features will include low-wing cantilever monoplanes, retractable landing gear and streamlining for vision and wing-fuselage flow requirements. Ease of flying will be improved by control research. Stall control will be independent of movable slots, flaps or the like. Landing speed and glide path will be controllable by means of high-lift devices. Tail surfaces will be cantilever of the "staggered" type for elimination of mutual interference.

Engine development will be along lines of increased power, decreased size and generally clean arrangement, with reliability the prime design keynote. A manual or automatically controllable propeller will be necessary for all types because of high speed ratios and also to obtain single-engine performance on the twin model. Gearing will become general as speed increases. Other probable design features, including the installation of two-way radio equipment and further instruments as standard equipment, are noted. *Southern Flight*, October 1941, pages 12, 13, 22, 23, 2 illus.

Asymmetrical Aircraft. Notes on various patents applied for since 1937 in connection with ideas for asymmetrical aircraft of various types. Essential characteristics of some are indicated. *Flight*, August 7, 1941, page 76h, 2 illus.

Stressed-Skin Evolution. An account of the research and experiment of the Bristol Aeroplane Company, Ltd., in the use of metal skin as an integral and important part of the stress-bearing structure. The evolution of this work, resulting in the Beaufort group of military aircraft, is described. *Flight*, August 28, 1941, pages 118f–118h, 7 illus.

Landing Speeds in Design. Peyton Autry. Summarizing aerodynamic design advances made in the matter of increased lift and resultant increased performance, this article notes some of the controlling principles of wing efficiency which now occupy the attention of design engineers and outlines the objectives of such study. *Flying and Popular Aviation*, October 1941, pages 51, 105, 2 illus.

Northrop's Flying Wing. A description of the Northrop Flying Wing which, after 18 months of test flying by several pilots, has been pronounced "successful" by its designer and builder, Jack Northrop. The general principle underlying the design of the aircraft is explained and the craft's performance qualites are compared to those of other more conventional types. *U.S. Air Services*, November 1941, pages 15, 16, 1 illus.

Die Stürzflugbremse (Air Brakes for Dive Bombers). A brief review of the use of air brakes for dive bombers. With the development of this type of airplane, a new aerodynamic auxiliary device found its way into aircraft construction in the form of air brakes. They consist of lift increasing surfaces which are attached either to the wing or fuselage. They are retractable and placed in proper position before the start of a dive, creating in this way an additional resistance.

It has been calculated that they reduce diving speed by about 150 km. per hour. Although the Junkers Ju 87 may be safely pulled out of a dive without air brakes, reduced speed is desired for tactical reasons, in order to get closer to the target, and also to protect the crew from excessive acceleration forces which affect the gunner in taking proper aim. The physiological effects of power diving and of the pull-out of a dive are briefly touched. *Der Deutsche Sportflieger*, May 1941, page 110, 3 illus.

Roller Bearings in Aircraft. A survey of some of the recent applications of roller bearings to new tasks in aircraft construction, such as part of the Dynafocal suspension for radial engines, on the throttles of the Holley carburetor and on the butterfly valve and on the air scoop of the Stromberg carburetor. The function of the bearings in each case is outlined in detail. *Aero Digest*, November 1941, pages 122, 126, 6 illus.

Range and Striking Power of the Fighter. Peyton Autry. A speculative forecast on the form which future fighter aircraft may take, indicating that the importance of maneuverability may lessen in favor of the increased speed and load and the protection afforded by a rear gunner.

This article is devoted to a study of the determining design factors observed in the present conflict which will ultimately dictate the trend of design. *Aero Digest*, November 1941, pages 112, 113, 126, 8 illus.

Tricycle Landing Gears. Lawrence Bell. The president of Bell Aircraft Corp. outlines the history of the rebirth of the tricycle landing gear. His comparisons are taken from the actual experiences of British fighter pilots now operating in England as well as from those of less skilled pilots who use this type undercarriage because it permits easier landing. *Aero Digest*, November 1941, pages 114, 115, 1 illus.

Detail Design of Wooden Wings. H. R. Foottit. A study of some of the practical considerations in the design of wooden wings. It includes an examination of various types of rib and spar construction, particularly such points as shear stress at the spar openings, tolerances and other major considerations. The discussion is presented in the light of improved technique made possible by the introduction of phenolic glues and protective coatings. *Aero Digest*, November 1941, pages 168, 171, 172, 175, 179, 10 illus.

The Flexible-Sleeve Multiple-Oil-Film Radial Bearing. Gustave Fast. This paper describes the multiple-oil film radial bearing development, and summarizes and discusses data derived from tests conducted under different conditions of speed, load and oil viscosity in order to determine the bearing's operating characteristics. *Transactions of the A.S.M.E.*, November 1941, pages 725–733, 6 illus.

Fighter Philosophy. Russian and American opinions on the design of fighters are presented in the form of an abstract of an article by M. P. Stroyeu, published in the Russian journal *Aeronautical Engineering* and an article by Lawrence D. Bell reprinted from a recent issue of *Aviation*.

The Russian writer considers that fighters of all types should be designed exclusively for aerial combat, any other function to be regarded as subsidiary. Two standard fighter types are necessary, he finds: high-speed and maneuverable single-seater monoplanes, and long-range, two-seater, twin-engined machines. According to his view, it would be desirable for general aerial combat to replace the existing single-seater fighters by a pusher-propeller type, subject to suitable technical development of this arrangement. More attention, it is said, should be paid to the further mechanization of the wing by means of flaps and other devices to combine the qualities of maneuverability and high speed in a single type of fighter.

The American view, as expressed in the philosophy behind the design of the Bell Airacobra, is said to call for a "winged weapon with a knockout punch." The manufacturer of the Airacobra considers this the basic reason for fighters and notes that every airplane ever built by Bell first considered armament location, revolving the development of design about this point. *Flight*, September 25, 1941, pages 193–197, 12 illus.

Post-War Empire Air Service to the Antipodes in 40 Hours. John W. Morrison. A discussion of potential designs for an airplane type suitable to the Empire Air Service which is contemplated for post-war Britain. Specific requirements for such an airplane type and design problems entailed are treated, among them operational speeds, engine installation, excessive drag and inter-stage speeds.

A number of commercial airplane designs in progress prior to the current war are described and compared, with notes on their relative adaptability to the needs of the Empire Air Service. Among these are the Short 14/38, the Fairey F.C.1, the de Havilland Albatross and the Lockheed 144-14 Excalibur. *Flight*, September 4, 1941, pages 132d,132h, 5 illus.

The Ideal Trainer. Ex R.F.C. A discussion of present-day British types of training aircraft, this article sets forth the writer's views on the ideal trainer, with the comment that "the United States has probably made the nearest approach to the ideal type." His own conception calls for a side-by-side cabin monoplane, with maximum visibility, and constructed of welded-steel tubing with fabric covering. *Flight*, October 2, 1941, pages 214f–214h, 215, 216, 10 illus.

The Bristol Beaufighter I. A cutaway drawing of the Beaufighter I, showing in detail the type of construction and main design features. A number of other detail drawings show component units and fittings. *The Aeroplane*, September 12, 1941, pages 282, 283, 14 illus.

Engines

Another Engine Layout. Description of a novel cylinder arrangement recently patented by Daimler-Benz, German engine builders. The cylinders are arranged in six banks of six each, the banks being arranged with an angle of 40°, between them, and a gap of 100°, between groups. Other details are given along with notes on the feasibility of such an arrangement. *Flight*, July 31, 1941, page 66, 1 illus.

Jumo versus Merlin. In order to determine the advantages and disadvantages of fuel injection, a Junkers Ju 211-D engine was taken from a Heinkel He 111-K which made a forced landing in England. The Royal Aircraft Establishment made extensive tests, especially on fuel consumption under any possible load. The results were compared with those obtained of a Rolls Royce Merlin engine, and reported here.

The total weight of the fuel injection installation is about 55 lbs. while the carburetor of the Merlin weighs about 23 pounds. The maximum delivery of the fuel injection engine is 2,400 r.p.m., while the regular output of the Merlin is 3,600 r.p.m. Due to the perfect mixture control in the carburetor high octane gasoline may be used in the Merlin, while its use in the Jumo is impossible. *Vliegwereld*, September 4, 1941, page 488, 2 illus.

Carburetor, Injection, or —? Charles H. Fisher. A general approach to the carburetor vs. fuel injection problem is furnished in this article comparing the different systems of supplying fuel to aircraft engines. The chief advantages and disadvantages of cylinder injection as against conventional carburetion are listed in table form. Advantages of both systems are said to be approached in the arrangement of continuous spray injection afforded by the Stromber injection carburetor, developed by the Bendix Products Division of Bendix Aviation Corp.

This system involves continuous injection into the supercharger eye, or entry, and is described in relation to two other arrangements developed in the United States concurrently. One of these is timed injection into the cylinder head, and the other is timed injection into the inlet port or manifold of each cylinder.

The writer predicts the the production emergency will probably preclude any drastic change of British policy with regard to systems of fuel supply until after the war is over. But, he suggests that when post-war design settles down to peacetime research all the larger engines, especially those for military aircraft, will be equipped with some form of injection. *Flight*, August 21, 1941, pages 104g, 104h, 1 illus.

BMW-Motoren 132F, K und N (The B.M.W. Engines 132F, K and N). A description of three aircraft engines developed from the standard B.M.W. series, of which the A, D, H and L types are already known. The three new types now made public have automatic fuel injection. Types F and N are designed as altitude engines, while type K is a ground supercharged engine. Continuous power output is 650 hp. in 4,300 meters for F, 665 hp. in 4,500 meters for N and 690 hp. in 1,800 meters for K.

The construction of the three types is similar except for the propeller drive and some instrument connections. They are 9 cylinder radial engines with two-piece crankshafts. The reduction gears of the three types are especially characteristic for the development tendency: 132 F has the well-known epicyclic bevel gear, 132 K and N a slur wheel gear, the first one with a double planetary pinion, the latter with a single one. *Der Deutsche Sportflieger*, May 1941, page 120, 3 illus.

The Allison Aircraft-Engine Development. R. M. Hazen. The vice-president and chief engineer of the Allison Division of General Motors Corp. reviews in this paper the step-by-step and model-by-model development of the Allison V-1710 aircraft engine—the first liquid-cooled military aircraft engine in production in this country. Since 1930, when the design of this V-type 12-cylinder engine was initiated, the power plant has been stepped up from 650 hp. without supercharging to 1,000–1,500 hp. in its supercharged state, and the weight has increased from about 1,000 lbs. to 1,320 lbs.

Three underlying reasons are set forth for the building of the first V-1710 engine. (1) The V-12 type of construction, with its small frontal area, could be installed with less drag than any other type of engine. (2) A liquid-cooled engine could be operated at a higher power output per cubic inch due to the type and uniformity of cooling. (3) The liquid-cooled engine would be more reliable because it is less sensitive to temporary overloads on account of the heat capacity and limiting temperatures (boiling) of the coolant. Additional advantages discussed are flexibility of radiator installation and of engine location. *S.A.E. Journal*, November 1941, pages 488–500, 21 illus.

Pressure Injection. Charles A. Fisher. A descriptive study of the Stromberg pressure injection system developed by Bendix Aviation Corporation's Bendix Products Division. The design and operative characteristics are explained in much detail.

The system consists of metering the air along through a fairly orthodox arrangement of double venturi and imposing the resulting pressure differential across a diaphragm assembly

which controls the flow of fuel into the carburetor. The carburetor embodies automatic correction for altitude, together with automatic mixture enrichment for high power and the usual manual mixture controls. *Flight*, September 11, 1941, pages 149, 152, 4 illus.

Kinner R-53 Engine. Structural and operational description of the Kinner R-53, a five cylinder radial engine designed for use in trainers. *Aero Digest*, November 1941, page 179, 1 illus.

Motores de Aviacion (Aircraft Engines). Arnaldo Pacanins. A comparative study of air-cooled and liquid-cooled engines, and of their use in modern airplanes. *Alas*, May 1941, pages 4, 5, 2 illus.

Some of the 123 Wasp-powered Vultee basic trainers recently delivered to the Army and Navy in a single day. This is believed to have been the largest mass delivery in history.

Flight Technique

Things I Am Doing Wrong. Devon Francis. A pilot with 160-odd hours of solo time and who finds he has been "doing certain things wrong" ever since he attained his airman's certificate notes a variety of such incidents as a caution to the careless or over-assured pilot. *Air Facts*, November 1941, pages 40–45.

The Student Goes Cross Country. Denman Whitney. A discussion of cross-country flying problems based on the contention that practically all pilots are students when they encounter certain phases of flying. Situations and problems encountered in cross-country flying other than the routine triangular trips necessary to qualify for certificates are described with suggestions as to how they should be met. *Air Facts*, October 1941, pages 12–17.

The Sensing of Speed and Lift. Wolfgang Langewiesche. Prefaced by an explanation of the meaning and importance of sensing lift and speed, this article offers practical suggestions for the student pilot on how to attain this sense and how to use it. Among the methods described for gaging speed are stalling with the airplane nose down, ear clues to speed variations, control feel, angle of attack, kinestesia and aileron feel. Also described are unreliable methods for gaging speed; the fallacies of such methods are explained. *Air Facts*, October 1941, pages 25–33, 36–39.

Scientific Control of Transocean Flight. John C. Leslie. The second of three articles of Pan American Airways operating policies, this installment discusses the technical phases of transatlantic flight operations. Major subjects are Pan American's engineering studies of the economies of fuel economy and of flight time analysis, both of which are dealt with in much detail. The aim of Pan American engineers is for specific fuel consumption of 0.36 and propeller efficiency of 89 per cent. The respective figures attained to date are 0.40 and 87 per cent. Flight time analyses show that exceedingly high long-range cruising speed, with resulting schedule regularity and constancy of available payload, is an essential requisite of profitable transocean aircraft. *Aviation*, November 1941, pages 58, 59, 188, 190, 192, 6 illus.

From Fixed Wing Aircraft to Helicopters. C. L. Morris. A discussion of "what it feels like" to make the transition from piloting conventional aircraft to flying the Vought-Sikorsky helicopter. *The Sportsman Pilot*, October 15, 1941, pages 10, 11, 34, 36, 2 illus.

Range and Fuel Economy. "Jinair." A summary treatment of those aspects of aircraft, engine and propeller efficiencies which enter into the technique of flying for maximum range. The use of constant speed propeller equipped aircraft is assumed for the purpose of the discussion, and means are suggested for attaining maximum range. *Flight*, September 18, 1941, pages 179, 181, 2 illus.

Flight Testing

Teaching Aeroplanes to Fly. "Sparrow." A British manufacturer's test pilot gives an account of the many points a test pilot must watch when putting new aircraft through their initial paces. The items which must be checked in pre-flight, flight and post-flight tests are enumerated. *Flight*, October 9, 1941, pages 232–234, 2 illus.

Flight Test Procedure for Vultee Trainers. L. H. Cooper. A study of the procedure followed by the Flight Operations department of Vultee in testing their *Valiant* trainers. This department runs Vultee Field and operates the only private control tower in the country.

The article describes the operation and equipment of the tower which not only supervises traffic but acts as a monitoring station for setting aircraft frequencies. The procedures from the time the airplane leaves the assembly line to the final acceptance tests are reviewed, and the points for ground inspection and flight check are enumerated. *Aero Digest*, November 1941, pages 163, 164, 167, 198, 7 illus.

Fuels and Lubricants

Fuel...to Keep 'em Flying. R. T. Goodwin. The manager of Shell Oil Company's aviation department describes the advances in modern petroleum research which are making possible improved aircraft engine performance and increased production of aviation fuel. Aviation fuels of the first World War and the development of fuel testing methods, of octane, iso-octane and other high octane fuels are described. *National Aeronautics*, November 1941, pages 10–12, 4 illus.

Gliding and Soaring

Silent Wings, Take off! Leeds Mitchell, Jr. The business manager of Motorless Flight Institute writes of the new and important uses being found for motorless craft, with stress on their adaptability to military needs. *Yankee Pilot*, November 1941, pages 10–12, 18, 5 illus.

High-Altitude Flight

Altitude Equipment. A description of the Boering Aircraft Company's strato-chamber development and the turbo-supercharger development of the General Electric Company. The manner in which the strato-chamber and turbo-supercharger overcome the

limitations of altitude on both man and machine is explained. *Flight*, August 28, 1941, pages 118d, 118e, 4 illus.

Bombardeo Estratosferico (Bombing from the Stratosphere). A study on bombing flights in very high altitudes. The advantages and disadvantages of this type of bombing are described along with the special equipment of stratosphere bombers. *Aeronautica*, September 1941, pages 10, 11, 3 illus.

History

Firing Through the "Prop." An account of the early experiments with synchronizing gears to permit firing through the propeller disk. It is noted that the device as it appeared in its original form was never altered. *The Aeroplane*, August 29, 1941, page 224, 3 illus.

Bommenwerpers Vliegen over den Oceaan (Bombers Fly Across the Ocean). A comparison of the transatlantic flights of American bombers for delivery in England to transatlantic flights of about 20 years ago. *Luchtvaart*, September 9, 1941, pages 322–324, 8 illus.

The First Aerial Torpedo. Frederick H. Becker. An account of the origin of the aerial torpedo, air weapon which has received so much attention since the sinking of the German battleship *Bismarck*. The airplane used and experiments with launching of the first torpedo are described. *The Sportsman Pilot*, October 15, 1941, pages 30, 41, 2 illus.

Flying As It Was—Early Days of Naval Aviation. Rear Admiral John H. Towers. The chief of the Bureau of Aeronautics, U.S. Navy, notes his experiences in cooperating with Glenn Curtiss in the development of early naval aircraft just prior to the first World War. Some of these airplanes and incidents marking their development are described. *The Sportsman Pilot*, October 15, 1941, pages 14, 15, 36, 6 illus.

Junkers ha Cumplido 30 Anos de investigaciones Aeronauticas (Thirty years of Aeronautical Research by the Junkers Works). A review of the chief accomplishments of the Junkers Works in airplane design and construction during the past 30 years. *Avia*, September 1941, pages 181, 182, 5 illus.

Hydraulics

The Constant Pressure Hydraulic Pump. Hydraulic pumps of constant pressure with varying flow are being used on several of the latest airplane types. The operative characteristics and the general design as well as the variations of this type of hydraulic pump are described. *The Aeroplane*, September 26, 1941, pages 345, 346, 5 illus.

A Lockheed Development. A description of the new engine-driven pump developed by Lockheed Aircraft Corporation engineers for high pressure hydraulic circuits in aircraft. Both the pistons and cylinders have a fine mirror finish and are made to extremely close limits. The parts are interchangeable and not selected to fit. This high standard of accuracy makes it possible to operate at 3,000 psi. without the use of packing. Structural and operation details of the pump are given. *Aircraft Production*, October 1941, page 361, 2 illus.

Sistemas Hidraulicos Para Aviones (Hydraulic Systems for Airplanes). The first part of a series of articles on the principles of hydraulic operation. Elementary hand-operated hydraulic systems are described with an explanation of how such a system actuates wing flaps. *Aeronautica*, September 1941, pages 41–45, 9 illus.

Aircraft Hydraulic Pumps. Lieut. Harry J. Marx and Edward M. Greer. This second article in a series on aircraft hydraulic mechanisms outlines the aircraft design developments of recent years which have placed increasingly heavy demands on the source of hydraulic power, the pump. The effects of these developments are discussed and various types of hydraulic pumps are described to explain how these increased needs have been met. General operating characteristics are also reviewed. *Aviation*, November 1941, pages 60, 61, 172, 174, 176, 16 illus.

Hydraulic Systems Installations, James E. Thompson and Rodney B. Campell. The first in a series on aircraft hydraulic systems, this article studies the lines, fittings and fluids, giving general rules on proper installation of lines with respect to structure and proper function. *Aero Digest*, November 1941, pages 134, 136, 139, 140, 7 illus.

Icing

White Wings. C. S. Stebbins. The development of de-icers is outlined in this article along with an explanation of the common causes of icing and the menace created by ice formation on aircraft. *National Aeronautics*, September 1941, pages 18, 19, 4 illus.

Ice Formaton. "Jinair." A discussion of ice formation in pressure-injection carburetors and the means provided to combat it. The article does not apply in cases where the turbo-blower is fitted. The pressure-injection carburetor is described briefly with notes on its advantages. Since it has a throttle, which when partially closed constitutes a constriction, ice forms, particularly at small throttle openings, when moisture is present. Also evaporative cooling results in ice formation between the nozzle and the blower.

Two rules are given which, if followed, it is said, can almost completely prevent the formation of ice in the pressure-injection carburetor. The first is, to run on "cold air" intake at all times except when in rain or moisture at outside air temperatures of $-1°C.$ to $+16°C.$, then to apply "hot air." The second is that hot air is applicable only when rain or moisture is present and not when snow or solid ice is present. *Flight*, September 25, 1941, pages 200, 201, 1 illus.

Instruments

Flow Indicator. Description of an improved type of visible flow indicator, known as the "Akron" and primarily intended for use on pressure-lubricating lines, water-cooling lines, cooling coils, etc. The simple construction and operation of the indicator are explained. *Journal of Scientific Instruments*, October 1941, page 207, 1 illus.

The Sperry Flightray. The elements of design of the Sperry Flightray and the method by which it coordinates for pilots the indications on navigating instruments are described. The operation and reading of the instrument are also explained. *Flight*, September 18, 1941, pages 176–178, 2 illus.

Mechanical Flight Computor. Harry Wilkin Perry. A description of the function and use of the Librascope flight computor. The instrument is said to enable a pilot to determine within a minute or two, right up to the moment of taking off, the most efficient operating conditions for a flight of any distance under any set of variable factors such as gross weight of airplane, altitude, air temperature, wind direction and velocity, course of flight, engine revolutions per minute, horsepower and elapsed time of flight. *Flight*, September 18, 1941, pages 168a, 168b, 5 illus.

Blind Flying. William E. Jackson. Washington National Airport's instrument landing system and how pilots will use it are explained by the chief of the Radio Development Section, Technical Development Division of the C.A.A. He calls it the first commercial airport to be so equipped for other than primarily experimental purposes. *Airlanes*, September 1941, page 14, 1 illus.

Jet Propulsion

Possibilities of Jet Propulsion. Parts I–IV. G. Geoffrey Smith. Conclusions of the study and experiment undertaken by engineers in various countries to develop prime movers alternative to the engine-propeller combination. The first of the four articles in the series indicates the line of development being followed by Germany and Italy in this field and presents original aircraft designs and layouts.

The second presents further designs of aircraft units employing rotary and reciprocating compressors and describes jet impulse reaction projects of British, Swedish and Swiss engineers. Part three reviews other British and foreign power plants, discusses the thermal jet principle and points out the influence which jet propulsion would have upon the design of aircraft generally if proved to be efficient.

The last installment presents an American investigation, summarizes in list form the possible advantages of jet propulsion and includes a part-sectioned drawing of an imaginary jet-propelled airplane embodying many of the proposals described in the series. *Flight*, August 28, 1941, pages 115–117, 3 illus.; September 11, 1941, pages 155–158, 6 illus.; September 25, 1941, pages 190–192, 201, 5 illus.; October 9, 1941, pages 239–242, 4 illus.

Rocket Propulsion—I and II. F. W. Lanchester. The first of these two articles discusses the rocket as a simple form of thermodynamic engine, subject to the same fundamental laws and limitations as other kinds of heat engines. The second deals with the rocket as a means of "boost" both when taking off and when a burst of speed is desired beyond the power of the motive power installation.

It is concluded that for general purposes of propulsion the rocket is too severely handicapped by tangible limitations. The range of flight is paltry in comparison with other methods; the thrust is not under the direct control of the pilot and cannot be made so; and the extent of the take-off boost necessary is very much greater than in an aircraft driven by engine and propeller. But, the writer considers that "for the purpose of giving a boost to a propeller-driven machine the rocket may well have a future." *Flight*, August 7, 1941, pages 78–80; September 4, 1941, pages, 135, 136.

Materials

The Protection of Aluminum and Aluminium Alloys. Elektron. In explaining the anodic oxidation method of protecting aluminum, the writer notes that when the surface of aluminum is cleaned with almost any kind of abrasive material, a natural film of oxide is immediately formed upon the surface. The film is of 0.00001 in. thickness, much too thin for use in aircraft. By various chemical processes the film can be increased to 0.0002 in. and by electrolytic treatment to 0.008 in., which is considered satisfactory for the protection of aluminum and aluminum alloys (including duralumin) in most types of aircraft in use today.

The anodic oxide method as an electrolytic process is defined, and the treatment of parts before placing in the bath is discussed in detail. The current density to be used and voltage regulation are described. Two methods of testing the coating are suggested. *The Aeroplane*, August 8, 1941, pages 158–159, 4 illus.

Rivet Salvage. A system developed by The Glenn L. Martin Company for reclaiming waste rivets is described. Rivets are collected by passing an electromagnet over the floor sweepings to remove all steel parts. The unsorted rivets are then passed through a series of sifters comprising parallel bars which grade the rivets according to diameter. An automatic machine with hopper feed is used to sort the rivets for length into different bins. When large quantities of rivets are being dealt with, a hand-operated machine is used to separate those with different types of head. It is said that 80 per cent salvage is effected by this method. *Aircraft Production*, October 1941, page 351, 3 illus.

Spring Tension Fasteners Aid Aircraft Assembly. D. R. James. A summary of data on spring tension fastening devices adopted in aircraft construction. Weight and time-saving advantages, together with low cost and proved resistance against loosening under vibration have attracted considerable attention from aircraft engineers. The kinds described are flat, push-on, removable push-on, U-type, J-type, latching, flat anchor and tubular types and cable clips. *Iron Age*, October 2, 1941, pages 53, 54, 20 illus.

Aircraft Plastics. "Ersatz." Observations on the present status of plastic developments with relation to aircraft construction. Obvious strides in technque, it is said, are offset by the "painfully slow" progress in application of the improved materials. Whereas the United States has provided two or three efforts on complete plastic aircraft, development in England has been confined largely to date to "odds and ends of covers, fairings and such." Applications are especially urged by this writer for complete monocoque wings and fuselages with a minimum of internal structure and a consequent maximum of stowage space. *Flight*, August 14, 1941, page 94.

Airscrew Blade Materials. K. B. Gillmore. A member of the technical staff of the propeller division of the de Havilland Aircraft Company, Ltd., undertakes in this article an evaluation of the merits and disadvantages of wood, compressed wood, steel, magnesium and duralumin. The history of the adoption of each of these materials for use in propeller construction is reviewed.

The properties of each of these materials are described and compared in relation to ease and cost of manufacture, reliability and wear in service, reparability, weight and adaptability. Considering reparability and ease of manufacture of prime importance during wartime, since these are the qualities most essential in propellers for military aircraft, the writer concludes that the solid duralumin blade fulfills these conditions far better than any other type. *Flight*, September 18, 1941, pages 168e, 168f, 169–172, 8 illus.

Maintenance

Assembly, Maintenance and Repair of British Military Aircraft. J. I. Waddington. This article outlines the system that has been developed for uncrating and assembling U.S. aircraft shipped to England and the other parts of the British Empire for immediate use. The system of routine servicing of fighter craft, repairs caused by regular wear as well as by damage, is explained, as is the salvage routine which has been established to assure a minimum wastage of aircraft parts. *Aero Digest*, November 1941, pages 144, 147, 148, 151, 17 illus.

Better Service From Aircraft Cable. R. F. Kolde. A discussion of the control cable problems most frequently confronting aircraft engineers. Methods of design for circumventing these problems are presented, and the requirements for optimum operating efficiency are reviewed. *Aviation*, November 1941, pages 78, 79, 170, 8 illus.

Medicine

Undertryckskammaren (Low Pressure Chambers). Nils Sundgren. A study on low pressure chambers and their importance to aviation medicine. Physical effects of high altitude on the human organism are discussed and reference is made to the investigations of Ruff, Strughold, Krogh and Schnell. *Flyg och Motor*, No. 17 B, September 1941, pages V–VIII, 9 illus.

Sangre Pesada (Heavy Blood Pressure). Description and photos of the various phases of the physiological effects of acceleration on the pilot during a power dive. *Aeronautica*, September 1941, pages 14, 15, 1 illus.

Vliegende Dokters (Flying Physicians). An account of the Australian Aerial Medical Services, established to provide medical service in this land of enormous distances, where it often requires three days to ride from the fence to the door of the farm house. *Vliegwereld*, September 18, 1941, page 524, 2 illus.

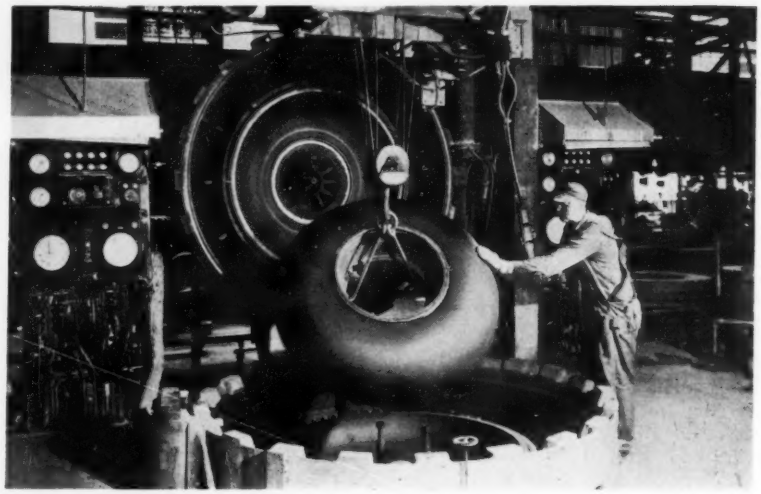
Il problema medico della stratosfera (Medical Problems of the Stratosphere). Taken from an article by H. Strughold in the August 1940 issue of *Luftwissen*, this brief treats of three kinds of effects produced on the human organism by a variation of altitude. A thermal effect is caused by the decrease of temperature; a mechanical change results from the decrease of atmospheric pressure; and a chemical change occurs with the decrease of the partial pressure of oxygen. These aspects of high altitude flight are investigated at length in this report. *L'Aerotecnica*, July-August 1941, pages 530—540, 12 illus.

Metallurgy

Nagra Betydelsefulla Tyska Lattmetallegeringar (Some Important German Light Alloys). A description of the light metals, Pantal and Bondur, and of the various KS and BS *Seewasser* (seawater) types. Their application to aeronautical construction is discussed and information is given on their composition and properties and on the heat treatment and aging of the metals. *Flyg och Motor*, No. 18B, September 1941, pages IV, V, 6 illus.

Meteorology

Wings That Swing. "Navigator." In explanation of the deflection of the wind as it moves down a pressure gradient, this article attempts to clarify Buys Ballot's law. Besides accounting for the deflection of a northerly or southerly wind by the West to East rotary movement of the earth, the writer shows how a given point on the earth's surface moves a certain distance in space during any specified period and so increasingly tends to magnify the deflection of the geostrophic wind. *The Aeroplane*, October 3, 1941, pages 360, 361, 10 illus.



A 56-in. tire built for the Consolidated B-24 emerges from a vulcanizer at the B. F. Goodrich plant. This type smooth-contoured tire with its tube weighs 235 lbs.

Military Aviation

Grasshopper Pilot. William D. Strohmeier. One of 14 civilian pilots of the Grasshopper Squadron of light airplanes employed in the recent U.S. Army maneuvers gives a conversational account of the manner in which these craft served a completely new mission for the Air Forces and demonstrated the practicability of this type of airplane as military air equipment. Flying problems unfamiliar to the civilian pilot—problems met in this new use of light airplanes—are described.

The craft were used for almost every conceivable purpose. Artillery fire was directed from them by use of two-way radio; they picked up messages on the fly, using a system similar to the air-mail pickup; and they flew provisions to isolated groups, besides serving many observation and reconnaissance functions. *Air Facts*, November 1941, pages 13—22, 3 illus.

The Light Plane—Cog in U.S. Defense. C. G. Taylor. The president of Taylorcraft Aviation Corp. reviews the position of the light airplane with regard to defense needs. He notes that while the light airplane has not been changed basically and will continue to be built and equipped with the utmost consideration for the needs of the private flier, wartime conditions have imposed restrictions on the building of light airplanes for other than defense needs.

The civilian "necessities" which can and need to be guarded by organized civilian plane patrol, and the military duties which can be performed by light airplanes are enumerated. The sole purposes for which Taylorcraft planes may now be bought are listed. *Dixie Air News*, October 1941, pages 6, 7, 2 illus.

Camion Taller de Campana (Field Repair Shops on Wheels). Modern warfare requires mobile shops to make repairs on airplanes, etc. This article describes such a shop-on-wheels and its equipment. *Aeronautica*, September 1941, pages 19, 36, 1 illus.

"Grasshoppers" Have Plenty to Do! Carl Friedlander. Discussing the place of light aircraft in National Defense, the president of Aeronca Aircraft Corp. writes that speed and long range do not alone make up our air needs. He cites the many uses of the light airplane for preliminary air cadet training, home guard patrols, air-mail service, messenger and liaison Army work, ambulance units and many other purposes.

Looking to the postwar period, he says that with an air-minded generation trained and ready to step into aviation, the upward surge in popular aviation will help cushion the postwar letdown only and if the light plane manufacturers will be in a position to continue to carry on their ever increasing efficiency and developments. *Dixie Air News*, October 1941, pages 10, 11, 25, 2 illus.

Tecnica del Bombardeo en Picada (The Technique of Dive Bombing). A description of the actuation and the aerodynamic effect of air brakes. *Aeronautica*, October 1941, pages 8, 9, 4 illus.

Parachutes

El Salto en Paracaida con Apertura Retardada—(Delayed Drop Parachute Descents—3). The conclusion of this series of articles discusses the calculation of speed and time of the drop. *Aeronautica*, October 1941, pages 18—21, 26, 27, 2 illus.

Personalities

F. D. Bradbrooke. A lengthy sketch, together with a note by C. G. Grey, on the career and the personality of the well-known pilot, navigator and aeronautical journalist, Francis Delaforce Bradbrooke, who was one of the casualties in the crash of an Atlantic ferry bomber on August 10. *The Aeroplane*, August 22, 1941, pages 192, 193, 3 illus.

Glenn L. Martin. A review of the career of Glenn L. Martin and of the development of his aircraft factory. *Vliegwereld*, August 7, 1941, page 433, 2 illus.

Lady Ace. Hill Edwards. Grace Huntington, a 27-year old flying instructor who is interested in getting aviation to give woman flyers a share of the jobs, is characterized in this account of her aviation career and activities. *Flying and Popular Aviation*, October 1941, pages 47, 66, 68, 1 illus.

Ambitious Mechanic. E. Jay Doherty. Orm Gove, recently promoted to the post of T.W.A. flight superintendent at LaGuardia Field in New York, is characterized in this story of his success in aviation via plans, persistence and hard work. *Flying and Popular Aviation*, October 1941, pages 33, 68, 1 illus.

Nel ventennale della morte di Joukowski (On the 20th Anniversary of the Death of Joukowski). A reminiscing essay on the contributions to aeronautics by this great Russian scientist. *L'Aerotecnica*, July-August 1941, pages 477–482, 1 illus.

Plants

Power Trucks and Human Push and Pull. Nels Swanson. The Warner & Swasey Company, machine tool plant, swamped with defense orders, has developed an intraplant transportation department with a fleet of power trucks to expedite the handling of materials and work in process. The system and its operation are outlined in this article. *Factory Management & Maintenance*, October 1941, pages 54–58, 150, 152, 154, 7 illus.

Ford Uses Electric Tunnel. Important developments in modern electrical design are described in this account of the electric power equipment in the new $30,000,000 aviation engine plant of the Ford Motor Company at Dearborn, Michigan. Underground substations, copper wrapped bus cables and column distribution cubicles are among the features described. *Electrical Contracting*, October 1941, pages 7–9, 7 illus.

Non-Magnetic Instrument Plant. A description of an entirely non-magnetic building recently added to the Kollsman Aircraft Instrument Plant. Non-ferrous metals were substituted for the common materials usually employed in order to obtain the elimination of outside magnetic fields. *Aviation*, November 1941, page 89, 4 illus.

Private Flying

Flying Rancher. Howard Osborne. Charles J. Belden, who says he doesn't have a private pilot's license because he has been "too busy flying to learn to fly," uses a Lockheed Electra to keep tab on the operations of his 200,000-acre stock ranch in Wyoming. He has had about 1,500 hours of flying private airplanes, including a Ford tri-motor and a Ryan, and also has done time on a Link Trainer. The many practical uses he finds for flying as a boon to business-like management of his herds and ranch property are described. *Flying and Popular Aviation*. October 1941, pages 31, 32, 82, 6 illus.

Skill Derby. Leverett G. Richards. Description of a recent contest for private pilots of the Pacific Northwest, sponsored by Roy C. Sugg and held at Seattle's Boeing field. Twenty-seven fliers piled up a total of 4,000 airmiles, touching at seven widely different fields, without anyone getting lost, losing any paint or having a mishap of any kind. All the fliers, three of whom were girls, won shares of the cash awards. *Flying and Popular Aviation*, October 1941, pages 41, 42, 92, 4 illus.

Some Vicious Aspects of "Hangar Flying." Notes on various types of misinformation which issue from the practice of "hangar flying," such as garbled interpretations of C.A.A. regulations and the gossip of those who would impress listeners with their complete fund of aeronautical knowledge. *Southern Flying*, November 1941, pages 35, 36.

Boston to the Yukon in a Beech 18 Seaplane. Pans Town. An account of a flight from Boston to Whitehorse, in the Yukon Territory, to deliver a used twin-engined Beechcraft 18 equipped with Edo floats. It is written in the manner of a log and contains extensive information on flying weather, the handling of the aircraft and the course taken. *The Sportsman Pilot*, October 15, 1941, pages 12, 13, 36, 38, 39, 4 illus.

Civil Aviation Cooperates in Russian War Effort. Lucien Zacharoff. A review of civil aviation activities in Russia with relation to their aid in the country's defense. The many defense services performed by civil aviation agencies and groups, both voluntary and organized, are outline. Airplanes, facilities and equipment used are described, and an account is given of domestic airline operations.

The subsidy and encouragement of civil aviation by the Government since long before the present war had placed it in a position where defense needs were readily able to commandeer all civilian resources to the utmost advantage when aggression came. *Aviation*, November 1941, pages 50, 51, 184, 186, 5 illus.

Production

More Wings for Defense! Stanley Anderson. The plant layout for increased fighter airplane production, built in seven months by the Curtiss-Wright Corporation Airplane Division at Buffalo, is described in this article which also notes the company's new plants at St. Louis and Columbus. *Airlanes*, August 1941, pages 4, 5, 20, 5 illus.

An Analysis of the Milling Process. M. E. Martelotti. This analysis of the milling process shows that the path of a milling-cutter tooth is an arc of a trochoid, the parametric equation for which can be derived from known variables of the cut. As a result, the milling process is susceptible to mathematical treatment. Practically, the advantage of such analytical methods is that such elements as the radius of curvature of the tooth path, the radial thickness of the chip, and their effects upon the quality of milled surface may be evaluated.

The paper demonstrates the advantages of the up-milling process in achieving machined surfaces of high quality. This form of analysis will also be found useful in comparing different milling methods. *Transactions of the A.S.M.E.*, November 1941, pages 677–700, 45 illus.

The Camera in the Planning Loft. Michael Lorant. The Glenn L. Martin Company's process for directly reproducing engineering drawings photographically on metal, wood, cloth and paper surfaces is described.

A large-scale camera is used for photographing the original drawing to scale, reproductions being made from negatives in print form on surfaces specially treated with photographic emulsion to take an impression of the drawing in the exact size of the finished part. *The Aeroplane*, October 3, 1941, pages 374, 375, 6 illus.

Do You Want Sub-Contracts? W. G. Green. The president of Engineering Laboratories, Inc., writes of the experiences of his firm in subcontracting on a large scale for the aviation industry. They started the hard way—inviting national defense work and got nowhere, then managed to secure some educational and preliminary small contracts from aircraft companies, and since then have been building aircraft parts in large quantities. Some of the problems met in handling National Defense contracts are described. *Southern Flight*, September 1941, pages 21, 22, 32, 5 illus.

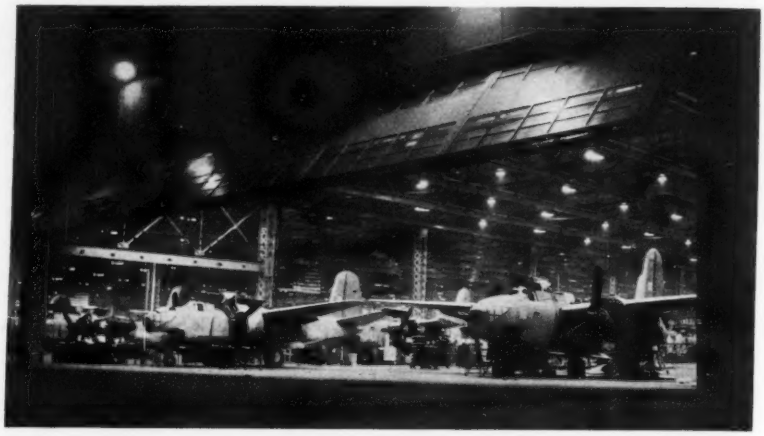
Limpieza con Chorro de Arena (Cleaning by Means of Sand Blasting). A description of sand blasting as a quick and economical method for cleaning castings and other metal parts. *Aeronautica*, September 1941, pages 22, 23, 26, 1 illus.

Production in the U.S.A. E. Speyer. An analysis of the American program for the production of military airplanes and the prospects of the program being met. The supplies of aluminum, machine tools, propellers and electric power are discussed as "bottlenecks," which it is said can be overcome if the American people gear their minds to the reality of the war issue and make the necessary sacrifices. *The Aeroplane*, August 29, 1941, page 236.

Assembling the Beaufighter. Bruce Foster. War-time conditions necessitate the building of the Bristol Beaufighter under an extensive dispersal program. The modern method of dividing the structure into separate assemblies is particularly adaptable to such a system. It is said that excellent results are being obtained without difficulty in the assembly of the various components.

This article presents a picture of the layout and operations at the factory where complete machines are assembled. The structural features and component parts of the airplane are explained with a description of the system used for component storage. An account is given of general assembly fixtures, procedure and operation, with details on engine installation and main plane assembly.

A new development in pipe-bending methods is noted. It makes use of wooden tools, and enables pipe bends to be pressed out accurately and quickly by one man using a small hydraulic press, whereas in the past this work was done largely by hand and was a slow process. *Aircraft Production*, October 1941, pages 347–353, 23 illus.



Night scene on the Boeing Aircraft Company's assembly line where Douglas *Boston* bombers are being completed under the BVD (Boeing, Vega and Douglas) design exchange agreement.

Perspective Drawings. Notes on the system of sketches and photographs developed by engineers at Douglas Aircraft Company for simplifying the work of assembly by providing visual instructions for unskilled and untrained workmen to follow in assembly jobs. *Aircraft Production*, October 1941, page 346, 1 illus.

Wooden Wing Manufacture. An account of production methods used by a subcontractor, Park, Ward and Co., Ltd., in the manufacture of complete wing units for Miles trainer aircraft. The jigs and procedure are described for the construction and drilling of main spars and for wing assembly and final operations. *Aircraft Production*, October 1941, pages 373–375, 9 illus.

Originality in the Bell Airacobra. A review of the construction and production methods applied to the manufacture of the Bell Airacobra. Structural and design features are described. Assembly operations are outlined with details on shaping and forming and special machine equipment used. *Aircraft Production*, October 1941, pages 364–367, 13 illus.

Interchangeability. B. Kaiser. A discussion of the factors underlying the attainment of interchangeability in the production of aircraft. For speed in production, the need for non-selective assembly and for quick replacement of damaged parts calls for a high degree of interchangeability.

The related problem of standardization of materials and equipment is treated particularly in terms of advances which could be made by eliminating overlapping specifications and by avoiding a multiplicity of designs in equipment intended for identical purposes. Drawing dimensions and manufacturing tolerances are also considered from the point of view of the practical engineer. *Aircraft Production*, October 1941, pages 376–381, 13 illus.

Quality Control. A. A. Tumser. A review of the checking and inspection procedures involved in various phases of Wright Aeronautical engine production. Inspection begins with the raw materials, forgings, bars, castings, tubing and lubricants which are subjected to physical and chemical analysis before they are released. Finished parts, such as valves, piston rings and spark plugs, are also subjected to close inspection.

The system of inspection used to assure high quality of the various components of the Wright power plant are described. X-ray, magnaflux, visual and dimensional inspections are applied. The procedure followed when a part is found to be below specification is also outlined. *Aero Digest*, November 1941, pages 152, 155, 156, 159, 160, 9 illus.

Plated Aluminum in the Aircraft Industry. Raymond F. Yates. A discussion of the new possibilities afforded aircraft construction in the form of aluminum covered with nickel, chromium, cadmium, copper and brass. *Aviation*, November 1941, pages 84, 146, 3 illus.

Molding the Langley Airplane. Randolph Hawthorne. An extensive description of the design principles embodied in the new bi-motor Langley monoplane, built of plastic-bonded plywood. The materials used and the manner in which they were adapted to solve design problems are described. Characteristics of the resultant model and specification and performance

figures are noted. *Aviation*, November 1941, pages 75, 76, 154, 156, 8 illus.

Air Defense Progress. T. P. Wright. The assistant chief of the Aircraft Branch of the Office of Production Management checks over his predictions of last January regarding the expansion to be expected in the aviation industry in the year 1941. Total production for 1941 coincides almost exactly with the advance estimates. The article presents a progress report on production expansion to date and elucidates the writer's statement that American production added to that of the British now surpasses that of the Axis powers. *Aviation*, November 1941, pages 46, 47, 180, 182, 6 illus.

Propellers

Ready for the Future. A discussion of the principles underlying the development of contra-rotating, constant speed, feathering propellers. Various problems confronting this type of propeller designing are pointed out in relation to the future requirements of aircraft. The subject is treated in connection with a description of a contra-rotating, six-bladed, constant speed, feathering propeller hydraulically operated—a recent development of Rotol Airscrews, Ltd. *Flight*, August 21, 1941, pages 104d, 104e, 3 illus.; also, **The Contra-prop,** *The Aeroplane*, August 22, 1941, page 211, 5 illus.

De Junkers Constant Toeren Schroef (The Junkers Constant Speed Propeller). Construction details of this propeller are given, showing results of an investigation made by the Rotol Airscrews, Ltd., on the propeller of a Ju 87-B which was shot down over England. *Vliegwereld*, September 25, 1941, pages 544–545, 1 illus.

Evolution of the Variable Pitch Airscrew. G. Geoffrey Smith. The history of the development of the variable pitch type of propeller is traced from its conception as a principle of propeller design some twenty years ago. The possibilities of this type of propeller to increase engine speed during take-off were recognized even before the first World War. But the advent of supercharged engines inspired the development of the idea, which was evolved as a design by Dr. H. S. Hele-Shaw, T. E. Beacham and H. L. Milner. Early research and the rôle of these three men in developing the invention are described. *Flight*, August 14, 1941, pages 90f–90h, 91, 6 illus.

Moderna Flygplanpropellrar (Modern Airplane Propellers). Tore Edlén. A review of the latest developments in propeller construction. Among the propellers described are the English Rotol and Fairey, the American Curtiss and Hamilton Standard, the German Junkers and the Swiss Escher-Wyss propellers. *Flyg och Motor*, No. 17B, September 1941, pages I–IV, 8 illus.

Improved Wood Airscrews. An account of American developments in molding technique and of the characteristics and production of Decat material, the product of a special process for compression and impregnation of wood. The mechanical properties of the material and the process of impregnation are described. Advantages of laminated construction both for propellers and other aircraft parts and structures are noted. *Aircraft Production*, October 1941, pages 355, 356, 3 illus.

Die Verstell-Lüftschraübe (The Controllable Pitch Propeller From the Pilot's Viewpoint). A few notes on the controllable pitch type of propeller from the practical viewpoint of the pilot. This type of propeller, and lately the automatic or feathering propeller, enables the pilot to make effective use of the engine output at heavy wing-loading. The propeller blades are properly set during take-off, climb, cruising and landing, and at forced landings the controllable pitch propeller has been a boon to the pilot. A description of the Junkers type VS full-feathering propeller is given. *Der Deutsche Sportflieger*, May 1941, page 108, 3 illus.

El Equilibrado de las Helices (Balancing of Propellers). Juan Wiener. A discussion of the procedure of balancing propellers. The most important condition required of propellers is perfect balance. The four principle phases of the procedure are static balancing of each individual blade, and static, dynamic and aerodynamic balancing of the assembled propeller. Each phase is analyzed by means of charts. *Aeronautica*, October 1941, pages 10,13, 6 illus.

Airscrew Developments. Brief description of two de Havilland propeller developments recently announced. One is the de Havilland all-metal four-bladed propeller; the other is a counter-rotating double propeller with three blades in each plane. Both have full constant-speed and feathering action. The developments are said to have risen from the phenomenal advance in the supercharging of big engines, increasing operating altitude to such a degree that three blades cannot provide enough blade area to work effectively in the rarer atmosphere. *Flight*, September 4, 1941, page 132, 2 illus.

Mechanised Inspection. A system is described for the use of grouped gages for the quantity inspection of small precision parts, components of Rotol governers for Rotol propellers. It permits the inspection on a quantity production basis of medium-sized batches.

The system comprises a complete set of gages mounted on a single plate and selected to cover every dimension of the component. The gages are so designed that in many cases several dimensions can be checked at a single setting. The sequence of operations is carefully arranged in a logical and natural order to eliminate unnecessary handling. Each gage is a separate unit which may be replaced when worn or if the dimensions of the component are modified. All parts throughout are hardened and ground, and the master gage plates are in the nature of precision instruments. *Aircraft Production*, October 1941, pages 357–361, 16 illus.

More Power and Four Elbows. Description of two propeller developments recently announced by the de Havilland Aircraft Co., Ltd. One is the de Havilland all-metal four-blade propeller for aero engines of 2,000 hp. and more; the other is the de Havilland counter-rotating double-three-blade propeller designed to absorb even greater powers. Both are constant-speed propellers with full-feathering action. *The Aeroplane*, September 5, 1941, page 258, 5 illus.

Radio

Position Fixes by D/F Bearings. C. H. McIntosh. The conclusion of a series of three articles by the writer dealing with various problems relating to instrument navigation of aircraft. This section presents essential information about "fixes" and the proper use of the D/F loop. *Aviation*, November 1941, pages 72, 73, 162, 164, 166, 168, 9 illus.

Precipitation Static. David S. Little. A summary of the progress made by air lines communications engineers in the suppression of precipitation static. It outlines the research which has been done on uncovering the cause of this interference, and describes the two major material steps made in ridding the communication systems of this annoyance—the shielded directional loop and the static suppressor cartridge.

The major portion of the article explains the engineering of the sup-

pressor cartridge. The operational theory, construction and practical use of the device are presented, as well as a discussion of the function of the static discharge wire and its possible exposure to lightning while in flight. *Aero Digest*, November 1941, pages 56, 58, 151, 3 illus.

Stress Analysis

Sul calcolo dei sistemi elastici (On the Calculation of Elastic Systems). G. Santangelo. This study assumes the elastic systems under consideration to be those generally called geodetic systems, consisting of a cylindrical surface stiffened by means of a plain and hogged framework, especially if they consist of such a framework only. Taking these explanations for granted, some simple calculation methods are given for the geodetic construction of a fuselage, the body of a rigid airship and other structures. The methods discussed may also be applied to other technical branches where the use of such elastic systems is contemplated. *L'Aerotecnica*, July-August 1941, pages 467–476, 8 illus.

Studio sulle solecitazioni nelle chiodature delle strutture a guscio (Study of Stresses on Riveted Joints of Shell Constructions). L. Lazzaroni. A report on analyses of continuous stresses on riveted joints of shell constructions. Formulas are derived for the approximate quantitative calculation of stresses. *L'Aerotecnica*, July-August 1941, pages 449–466, 7 illus.

Progress Report on Tubular Creep Tests. F. H. Norton. A progress report describing the results obtained on the creep of tubular specimens. An attempt is made to correlate the stress between the tensile specimens and the tubular specimens. The results obtained to date are said to indicate that the longitudinal creep of the tubes is substantially zero, and that the circumferential creep is approximately the same as the creep in the tensile specimen with a stress equivalent to the circumferential stress in the tube. *Transactions of the A.S.M.E.*, November 1941, pages 735, 736.

Interpretation of Creep Tests on Tubes. C. R. Soderberg. A companion paper to the Norton report reviewed above, this study contains a discussion of the phenomena involved in the light of the accepted theory of yielding, the theoretical basis for the present research program, and the significance of the results thus far obtained. *Transactions of the A.S.M.E.*, November 1941, pages 737, 748.

Flight Loading Conditions. The "flight envelope" method of setting out graphically the basic flying cases has been considered by the Civil Aeronautics Board, in overhauling its airworthiness requirements, as a possible new way for specifying the various conditions of flight for which the stresses in the airframe must be analyzed. This article explains the method and demonstrates its usefulness for examining the question of compliance of any particular aircraft design with any set of airworthiness requirements and for examining increases in weight and speed. *Flight*, October 2, 1941, pages 212–214, 7 illus.

Tools and Equipment

Weatherproofed for the Clouds. H. E. Linsley. An account of a mechanized installation to furnish the surface protection necessary on exposed parts of aircraft engines manufactured at one of Wright Aeronautical Corporation's plants. The system provides for plating and painting a wide variety of parts that are particularly susceptible to corrosion, many such parts being of aluminum and magnesium alloys. The equipment and successive operations in this finishing process are described. *American Machinist*, September 17, 1941, pages 907–909, 3 illus.

Modern Machine Tools. Recent improvements in various types of British machine tools are described. The equipment noted includes a new capstan lathe, a rotary table, machines to do keyseating, shaping, sawing and centerless bar turning and high-speed turning operations. *Aircraft Production*, October 1941, pages 368–370, 7 illus.

Shop Equipment and Small Tools. Details are given on the design and uses of various new equipment including a nibbling machine, a mechanical indicating gage, filing and polishing machinery and a type of adjustable steel partition for enclosed areas which require frequent replanning due to changing requirements of production. *Aircraft Production*, October 1941, pages 362, 363, 6 illus.

High-Speed Installation. Notes on methods used by Douglas Aircraft Company in achieving speedy installation of machinery at the new Long Beach plant. Planning installation beforehand is indicated as the chief factor in getting new equipment installed and in operation in short order. *Aircraft Production*, October 1941, page 381, 4 illus.

Training

D.H. Travelling School. In 1936 the de Havilland Aircraft Company, Ltd., established a school to provide instruction on the variable pitch propeller, having made the first delivery of its own product of this type the previous year. Now in its sixth year, this school is currently carrying its instruction to the pilots and engineers at their bases. The growth of this educational work and its present facilities are described in this article. *Flight*, August 7, 1941, page 76e, 2 illus.; also *The Aeroplane*, September 19, 1941, page 316, 4 illus.

Pilot Production. A brief outline of the organization of primary, basic and advanced pilot training in the U.S. Army Air Corps. The term of training in each group, type of instruction and equipment used, and general requirements of each course are noted. *Flight*, August 7, 1941, page 76d, 1 illus.

Canada Trains the Empire's Warbirds. James Montagnes. An account of the system and organization for training the British Empire's pilots and technicians at 100 air fields throughout Canada. The training said to be 18 months ahead of schedule and 25 squadrons are reputedly already overseas flying for the Empire. *Aviation*, November 1941, pages 56, 57, 160, 6 illus.

British Bomber Crews in Training. An account of the exacting course of study through which R.A.F. bomber crews are put to develop synchronization of team work. The methods used for this training and the psychology behind them are described by an R.A.F. officer. The devices used to create realistic training conditions simulating air warfare and bombing raids are explained. *Aviation*, November 1941, pages 52, 53, 140, 142, 144, 5 illus.

Flying Starts on the Ground. R. A. Seelig. A description of the ground school at Washington's National University, characterized as a typical C.P.T.P. ground school. Cost of the course, requirements, plan of operation and the instruction offered are outlined. *Flying and Popular Aviation*, October 1941, pages 34–36, 100, 3 illus.

Mobile Mechanics. Douglas J. Ingells. An account of the mobile units of enlisted men which form the latest additions to the Air Corps maintenance operations. Outgrowth of the demand for more repair and maintenance crews at new Army air bases, the units comprise men being trained as welders, sheet metal workers, propeller experts, machinists, pattern makers, master mechanics, photographers, electrical workers and radio mechanics. Training opera-

tions, now being conducted at Patterson Field, near Dayton, are described. *Flying and Popular Aviation*, October 1941, pages 52–54, 100, 6 illus.

The Indian Air Force. A description of the system by which mechanics are being trained for the Indian Air Force. The multiplicity of details about an airplane which require servicing is emphasized in an explanation of the intricate construction and operating equipment of military airplanes. The School of Air Force Technical Training is devoted to the specialized service technical training, affording a high standard of mechanic training in increasingly shorter periods of time.

It is supported by the Directorate of Civil Aviation's preliminary training scheme for air force mechanics, which provides a source of supply of skilled men for the Technical Training School. In addition there is a recruits' training unit which provides drill training and general service instruction. The training routine is outlined. *Indian Aviation*, July 1941, pages 170–172.

Flying Clubs in India. On the outbreak of World War II, facilities for the initial training of pilots for the Air Force in India were practically non-existent. This article describes the service performed by the flying clubs in India in feeding into the Indian Air Force men with preliminary air training. *Indian Aviation*, June 1941, pages 151, 152.

W.A.A.F. Mechanics. Photographs and a note on the ever-increasing number of ground duties being performed by trainees of the Women's Auxiliary Air Force who are being taught how to service and mantain engines and airframes. *Flight*, September 25, 1941, page 192c, 5 illus.

More Men for Skyways. Clyde V. Marvin. The work being done to train airline pilots at United Air Lines' pilot-training school, Tracy, California, is described with details on the courses taught and the qualifications of students. *Airlanes*, October 1941, pages 2, 3, 22, 5 illus.

Warfare

The Great Daylight Attack. An official account of the preparations and execution of the double air attack on the German naval vessels, Scharnhorst and Gneisenau last July 24. The Air Ministry News Service called the fray the biggest daylight attack yet made by the R.A.F. *Flight*, August 7, 1941, page 77.

Spotting by Night. I and II. Maj. L. E. C. M. Perowne. Two articles by an authority on the training of searchlight spotters dealing with the more significant aspects of spotter training. Selection of spotters is treated along with the optical and mental processes which combine in detection. The type of training used is described along with the exercises to be carried out and the proper employment and use of binoculars. *Flight*, July 31, 1941, pages 62a–62c, 18 illus.; August 7, 1941, pages 76a–76c, 17 illus.

The German Version of Air Operations in 1941. An interpretive review of a report of Germany's military operations since the beginning of the year, prepared by the German High Command and published in all German newspapers. The report treated of operations in Libya, the Balkan Campaign and the Crete campaign. *The Aeroplane*, August 1, 1941, pages 124, 125, 4 illus.

Sand-blasting rough castings at the newly opened $14,000,000 aircraft plant of the Curtiss-Wright Corporation at Port Columbus, Ohio.

Welding

Electric Arc Welding. A brief review of the advantages of electric arc welding as employed for rapid production at Vultee Aircraft, Inc. Methods of training personnel and inspection procedure are noted. *Aircraft Production*, October 1941, pages 375.

New Arc Welding Technique for Aircraft Tubing. I. B. Yates. A survey of the system of electric welding used by North American Aviation, Inc., at their plant in Dallas. The procedure followed in the welding of the steel tube part of the fuselage structure is outlined, giving particular attention to the problem of electric arc craters which were frequently found when the electric current in the equipment was suddenly turned off.

These craters produced a weakening in the metal, and were finally eliminated by the use of a "Stroco" eliminator, a device which permitted the gradual reduction of the welding current. The article explains the technique of the eliminator and outlines the special training that welders were given in its use. *Aero Digest*, November 1941, pages 126, 129, 130, 133, 244, 12 illus.

A Procedure Control for Aircraft Welding. A. K. Seemann. A discussion of the important factors in a procedure control for oxy-acetylene welding. The fundamental principles of the oxy-acetylene process are given to provide an understanding of this method of construction.

The essential elements in a procedure control for welding are treated in detail in proper sequence. They are said to be: design for welding, selection and inspection of materials, establishment of a routine to give desired results, qualification of the welding operator to follow the procedure, and inspection and testing of completed work. *Aviation*, November 1941, pages 66, 67, 144, 4 illus.

Wind Tunnels

Boston's Famous Low-Speed Wind Tunnel. Everett Tasker. A description of the only existing low-speed wind tunnel for extending the American Youth's knowledge of model aeronautics. Credit for the achievement is given to the members of the Junior Aviation League, one of the oldest and most active model airplane clubs. *Air Youth Horizons*, November 1941, pages 5, 6, 3 illus.

La grande galleria aerodinamica di Chalais Meudon (The Chalais Meudon Wind Tunnel). A detailed description of the Chalais Meudon wind tunnel. *L'Aerotecnica*, July-August 1941, pages 513–524, 13 illus.

Miscellaneous

Pilots Are Superstitious. Kenneth Brown Collings. This article is reported to be the last written by this aviator before being lost at sea last May along with ten other Americans en route to fly for the British. He was known for ten years as a prolific and capable writer on aviation subjects. This posthumous manuscript records many of the superstitions of airmen, notes their origins and reminisces on the experience of various well-known aviators in connection with such superstitions. *Flying and Popular Aviation*, October 1941, pages 24–26, 86, 7 illus.

Would You Like to Be a Clipper Pilot? S. Roger Wolin. The nature of the job of piloting a clipper and the training and requirements of those who qualify for apprenticeship with Pan American Airways are described. *Southern Flight*, November 1941, pages 26, 27, 34, 6 illus.

(*Continued on page 67*)

Government Publications

U.S. Army Air Forces

The Winged "O" for the Eyes of the Army. Oliver Townsend. An outline of the ten-week course for Air Force observers now in progress at Brooks Field, Texas. The course stresses code transmission, photographic and visual observations, as well as the general academic phase of military observation. The observer, after completing the preliminary stages of his training, is assigned to a pilot in order to learn to operate as a combat team. *Air Forces News Letter*, October 1941, pages 5, 6.

Aerial Traffic Cops Get Together. Major A. B. McMullen. An explanation of the function of the recently established Interdepartmental Air Traffic Control Board which consists of representatives of the Army and Navy air services and the C.A.A. While this board has no executive authority, it acts as a clearing house not only for the air traffic problems created by increased air traffic, but reviews applications and makes recommendations with respect to the use of the navigable air space for such activities as artillery firing, balloon barrages, bombing ranges and training fields. *Air Forces News Letter*, October 1941, pages 11–13, 34.

Civil Aeronautics Authority

Icing of Aircraft. B. C. Haynes. A study of icing problems on aircraft, presented in simple form to answer general questions asked on the subject, such as the conditions which induce icing, the zones in which it is likely to occur, the action of ice on the flying characteristics of the airplane and general precautions to insure safety under possible icing conditions. *Civil Aeronautics Board Safety Bulletin.*

Abbreviations and Phrase Contractions. A list of abbreviations and contractions of words and phrases in frequent use in connection with the C.A.A. Airways Communication Service and the Airways Meteorological Service. Symbols for common terms such as days of the week, months, cloud formations, states, aircraft types, air mass names, wind variations, etc., are given and a comprehensive list is given of words and phrases in common use in airways teletype communications. *Manual of Operations*, Chapter B, Part 4, Section 1, 60 pages.

Airport Lighting. A revised bulletin on present-day standards of airport lighting, explaining the function, construction and installation of the various units that make up an airport lighting system. Beacons and other identification lights, illuminated wind indicators, boundary and approach lights, boundary and obstruction markers, marking illumination and the ceiling projector are discussed, as well as floodlighting equipment, its control and efficient use. *Civil Aeronautics Bulletin No. 10.* Revised March 1, 1941.

Proposed Civil Air Regulations Revision. Proposed amendments to parts 20 and 50 of the C.A.R. relating to dual and solo flight experience required for pilots who have trained exclusively on two-way non-spinnable airplanes with nose-wheel type landing gear. The proposed revisions would reduce the pre-solo instruction time but would require additional check time before transfer to conventional aircraft. *Civil Air Regulations Draft Release No. 2*, October 30, 1941.

A Survey of Ground Accidents. A report on ground accidents to non-air carrier aircraft in 1940 indicated that of 543 aircraft damaged in 441 mishaps, two thirds required overhaul or replacement of an entire assembly or were completely washed out. A statistical breakdown of all ground accidents indicated that wind accidents accounted for over 40 per cent of the damage. Observations on the various categories of accidents are made and suggestions for their future prevention are given. *C.A.B. Investigation Division, Accident Analysis Division*, September 25, 1941, 17 pages.

National Bureau of Standards

Locating the Principal Point of Precision Airplane Mapping Cameras. Francis E. Washer. The location of the principal points with respect to the intersection of lines joining opposite pairs of collimation index markers was determined for numerous precision mapping cameras. Weak prism effect, present in most camera lenses, was measured by the Bureau of Standard's precision lens-testing camera and the influence on the location of the principal point was considered. It was found that these cameras required adjustments ranging from 2 to 25 times the allowable tolerance of ± 0.03 mm. in the location of the principal point. *Journal of Research*, October 1941, pages 405–412, 7 illus.

National Advisory Committee for Aeronautics

The Design of Jet Pumps. Gustav Flügel. Translation of an article entitled "Berechnung von Strahapparaten." which appeared in *VDI-Forschungsheft 395*, March-April 1939, on the progress that had been made on development of jet pumps.

The report indicated that applying both the energy and the impulse theorems the optimum throat dimension of the mixing nozzle and the best shape of intake can be predicted approximately in a relatively simple manner. The necessary length of the mixing nozzle follows from Prandtl's turbulent mixing theory. The calculations are carried out for the mixing of similar and dissimilar fluids. *N.A.C.A. Technical Memorandum No. 982*, July 1941, 62 pages, 14 illus.

The Mechanical Properties of Wood of Different Moisture Content Within —200° to +200°C. Temperature Range. Franz Kollmann. Translated from *VDI-Forschungsheft*, July-August 1940. A report on the changes in the mechanical properties of wood with temperature, taken from a series of experiments, undertaken to determine the effect of various temperatures on gross specific weight, modulus of elasticity, and the effect of freezing on compressive, flexural and impact strength. *N.A.C.A. Technical Memorandum No. 984*, September 1941, 37 pages, 28 illus.

New Frictional Resistance Law for Smooth Plates. F. Schultz-Grunow. Translated from *Luftfahrtforschung*,

August 20, 1940. Summarized in the *Aeronautical Review*, December 1940, page 10. *N.A.C.A. Technical Memorandum No. 986*, September 1941, 15 pages, 17 illus.

Contribution to the Aerodynamics of Rotating-Wing Aircraft. G. Sissingh. The interrelations established in an earlier report on this subject (N.A.C.A. Technical Memorandum No. 921) are used to study the best assumptions for hovering and horizontal flight. The effect of the twisted and tapered blade on the rotor efficiency is analyzed and the gliding coefficients at different stages of horizontal flight are compared. To the extent that model or full-scale data are available, they are included in the comparison. Translation of a report from *Luftfahrtforschung*, July 20, 1941, entitled "Beitrag zur Aerodynamik der Drehflügelflugzeuge." *N.A.C.A. Technical Memorandum No. 990*, October 1941, 13 pages, 23 illus.

The Oscillating Wing with Aerodynamically Balanced Elevator. H. G. Küssner and L. Schwarz. The two-dimensional problem of oscillating wing with aerodynamically balanced elevator is treated in the manner that the wing is replaced by a plate with bends and stages and the airfoil section by a mean line consisting of one or more straights. The computed formulas and tables permit, on these premises, the prediction of the pressure distribution and of the aerodynamic reactions of oscillating elevators and tabs with any position of elevator hinge in respect to the leading edge. Translation of an article in *Luftfahrtforschung*, December 10, 1940, entitled "Der schwindige Flügel mit aerodynamisch ausgeglichenem Ruder." *N.A.C.A. Technical Memorandum No. 991*, October 1941, 30 pages, 5 illus.

Statistical Analysis of the Time and Fatigue Strength of Aircraft Wing Structures. Hans W. Kaul. A statement of the results from stress measurements in flight operation, affording data for analyzing the frequency of appearance of certain parts of the static breaking strength during a specified number of operating hours.

Considerable data covering the wing stressing of six different civil aircraft ranging in weight from 2,000 to 6,000 kg. were subjected to statistical analysis. The stress frequency of application curves for three aerobatic aircraft was also investigated. From these studies, it is possible to estimate the probable number of times loads of a given magnitude will be applied to the wing structure over flying time ranging from 2,000 to 6,000 hours and to adjust the ground tests accordingly. Translation from an article, "Die erforderliche Zeit- und Dauerfestigkeit von Flugzeugtragwerken," in the *Jahrbuch 1938 der deutschen Luftfahrtforschung. N.A.C.A. Technical Memorandum No. 992*, October 1941, 31 pages, 13 illus.

British Library of Information

Catafighter: "Bee With a Single Sting." An announcement of a new technique in protecting convoys against attack by sea-ranging bombers such as the four-engined Focke-Wulf Condor. Merchant ships are equipped with a catapult-launched single-seater fighter. If the convoy is attacked, the fighter is launched. After the engagement is over, if the pilot has sufficient fuel, he attempts to make land. If not, he takes to his parachute and is picked up by the vessel. The loss of a fighter valued at $20,000 or $30,000 is considered an adequate exchange for a four-engined long-range raider costing about a quarter of a million. *Bulletins from Britain*, October 26, 1941.

Cross-Channel Invasion Bombing Task. William Courtenay. A statistical opinion on the military task of a British invasion of the continent, which indicates that the coastal area in which the operation must take place, from the Hook in Holland to Brest, has been so heavily fortified that a frontal attack would be repulsed with heavy losses.

In place of an artillery attack which the German efforts have indicated to be futile, the writer suggests a concentrated air attack against the fortifications, using large aircraft carrying three two-ton bombs each. Operating in waves launched at five-minute intervals, 4,800 bombers an hour would clear the area to the depth of fifty miles by reducing the fortifications to rubble and sealing both ends of the channel against air or sea attack.

Such an attack would require 10,000 bombers, active crews of 40,000 men, reserve crews of 120,000 gunners, spare pilots, etc., and a commensurate number of supporting aircraft. *Bulletins from Britain*, November 12, 1941, pages 11, 12.

British Library of Information

The Navy That Flies. "Bartimeus" (Capt. Lewis Ricci). A brief history of the British Fleet Air Arm, which began its service as the Royal Naval Air Service in the early days of the first World War. *Bulletins from Britain*, October 1, 1941, page 4.

The Battle of Britain. A pictorial account of the action of the R.A.F. in combating the mass air attacks on England between August 12 and October 31, 1940. The account gives the general plan of the attack and defense, and the number of losses on both sides. *Neptune*, June 1941, pages 8–11.

R.A.F. A picture survey of the R.A.F. in action, starting with a camera visit to an Initial Training Wing with the distinguished British photographer, Cecil Beaton, a study of the defensive armament of R.A.F. bombers, and the equipment and personnel of the night fighter units. *War in Pictures*, June 1941, pages 6–13, 17 illus.

Aeronautical Research Institute, Tokyo Imperial University

Resistance Welding Light Alloys. A report made by the Resistance Welding Research Committee of the Aeronautical Research Institute on the application of electric resistance welding to light metals and alloys in aircraft construction. The findings of the committee, which has been carrying out their investigations since 1936 on such variables influencing the result as the magnitude of the current, time of flow, electrode pressure, material and shape, and the composition, thickness and surface of the material to be welded are given.

The committee concluded, among other things, that the heavier the intensity of the current, the higher the shear strength of the weld; that the shape of electrode was a critical variable, and that slight differences in welding time were not as critical as previously thought. *Tokyo Imperial University*, A.R.I. Report No. 210, 482 pages.

The Characteristics of an Airfoil With Discontinuities Along the Span, With Special Reference to the Effect of Cut-Out. Tetusi Okamoto. A paper, dealing theoretically with discontinuities along the span like an airfoil with rectangular cut-out, flap or aileron. The approximate method for calculating lift distribution allowing for discontinuity is outlined, showing the procedure for practical application of the method.

In a second section of the paper, the characteristics of the airfoil with longitudinal slots are studied, and special cases of divided airfoils and airfoils with cut-outs are solved. In the third part, characteristics of airfoils with rectangular cut-outs are calculated, showing that the calculated results in all three cases agree with experimental results. *Report No. 208 of the Aeronautical Research Institute, Tokyo Imperial University*, May 1941.

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Vibration Test Revision

This text on the torsional vibration of engine crankshafts was originally printed in 1935 in a single volume. The new version, brought up to date and much embellished, required two volumes. The first appeared last year.

The second volume of the new edition shows considerable enlargement of subject matter and more comprehensive treatment. More detail is given on flexible couplings, including the use of rubber as a structural material, with special reference to rubber-in-shear couplings. Additional material relates to the choice of crank sequences and firing order of various engine aggregates, including single and multi-row radial engines, with articulated connecting rods, and V-type in-line engines.

Other new information is included in the treatment of geared engines supported on flexible mountings. Modern vibration measuring instruments and the latest electrical instruments for the purpose are discussed fully. The entire handling of engine damping is revised in the light of developments since 1935; an entire chapter is given to rotating pendulum vibration absorbers.

The properties of materials used in transmission systems are dealt with in much greater detail than in the earlier volume. Included is a study of fatigue phenomena with special reference to the influence of discontinuities in causing stress concentrations.

A more extensive section than before is furnished on propeller blade vibration and its influence on the vibration characteristics of power plants. The bibliography is much enlarged, and a listing of British patents relating to torsional vibration has been added.

Practical Solution of Torsional Vibration Problems, Volume II, by W. Kerr Wilson; 2nd edition, John Wiley & Sons, New York, 1941; 649 pages, $8.50.

Power Plant Primer

A school and apprentice's text on modern aircraft engines, this work from the "*Flight*" series maintains a modern note throughout. Glossing only lightly over the history of power plants, it explains the operating principles of the four-stroke-cycle engine in terms of power plants in current use.

Having established the principles, the writer discusses operation of the engine and its components, explaining each individually. The function of the carburetor, the principle of its operation and the basis of its design are outlined. Several types of simple and advanced carburetors, and the fuel injection system are described. Induction systems and superchargers are also treated.

Books reviewed in this section may be purchased, or borrowed without charge, from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, Rockefeller Center, New York, N. Y.

The study of ignition examines the elementary principles of magnetism and electricity, and the general characteristics of magnetos and spark plugs, wiring, switches and storage batteries, starters and generators. Their use, care and maintenance are outlined.

Details are given on several popular types of engine, particularly some of the opposed type popular in light aircraft, and some of the smaller in-line and radials to familiarize the reader with the Continental, Franklin, Menasco, and Lycoming engines. Wright, and Pratt & Whitney engines are also reviewed from the production and maintenance angle. The book closes with a general examination of valve and ignition timing, and fuels and lubrication. The contents of the entire text are then pointed up in a series of questions and answers.

Flight—Aircraft Engines, by Ray F. Kuns; American Technical Society, Chicago, 1942; 363 pages, $3.25.

Air Transport and Regulation

A study of the economic and legal characteristics of the air transport industry which bring it under federal regulations, this authoritative work presents a complete and detailed analysis of all the activities of C.A.B. and C.A.A., the decisions of the Interstate Commerce Commission in air-mail cases from 1935 to 1938. It also deals with the activities and powers of other governmental agencies which affect the airlines. Airline rates are thoroughly analyzed and discussed. The entire work is exhaustive in treatment and presented in a most useful form.

Air Transportation, by Claude E. Puffer; The Blakiston Company, Philadelphia, 1941; 675 pages, $3.75.

Mechanic's Handbook

The basic data that the average mechanic uses in his daily work have been collected and put into a handy pocket-sized manual by J. A. Ashkouti. This book crystallizes the facts and figures which are part of the craftsman's equipment, just as much as tools or material.

All the essential identifications in common use, the interpretation of Army, Navy and civilian designations, the code color of materials such as aircraft piping, cable, aluminum, ferrous and miscellaneous alloys and even shock cord are listed, together with wire gage standards, alloy stock sizes, comparative hardness and tensile strength tables, and tolerance and weight listings.

The elements of aircraft layout, ordinary shop arithmetic and commonly used mathematical short cuts, tables and general procedure on flat pattern layout are also presented. The bending allowance tables for aluminum alloy and sheet steel are given in singularly useful form.

The remainder of the work contains equally useful information on such subjects as finishes and heat treating, standard Army and Navy parts with complete charts on their specifications and sizes, and general material on screw and pipe threads, fasteners and bearings. The chapter on the handling of aircraft tools reflects the author's personal familiarity with the most practical phases of production.

The final section contains a modern shop nomenclature and a list of standard abbreviations with which the average mechanic or shop worker is expected to be familiar. This book testifies to the wide practical experience of its compiler, who knows what information the average mechanic wants to pack into a tool box along with his hacksaw and files.

Aircraft Mechanic's Pocket Manual, by Joseph A. Ashkouti; Pitman Publishing Corporation, New York, 1941; 160 pages, $1.50.

Introduction to Aircraft Tools

The rapid influx of new and semi-skilled personnel into aircraft production has brought with it large numbers of people totally unfamiliar with machine tools and their use in the production of airplane parts and components.

Taking no previous knowlege of machinery for granted, the book introduces the machines in popular use in aircraft factories, giving their function, operation and use. The general field of aircraft machines is divided into three sections: standard machines in universal use with no special application to aircraft, semi-automatic and fully automatic machinery and machines designed to perform specific functions in aircraft construction exclusively. The entire field is also divided roughly into two functions, namely, metal cutting and sheet metal fabricating equipment.

The machines characteristic of the various steps in airplane building, the lathes, milling machines, grinders, contouring saws, drill presses and boring mills are explained as are the special high production devices such as centerless grinders, precision boring machines, turret lathes and duplicators. The function of the toolroom is also given particular attention.

Differing from many previous introductory works, this book handles the problem of sheet metal fabrication strictly from the modern production sense, introducing only the currently applied methods of cutting and shaping stock, besides the usual common band saw and bumping hammers, the late types of shears, shapers, presses and drop hammers, also the stretch press are explained. High speed cutting tools such as the radial-arm router and drill, spar-cap mill and spindle shaper, and the most recent additions to the production system are dissected and their particular function outlined.

The book closes with a tabulated analysis of machine tool requirements as applied to modern mass-production of aircraft and sub-assemblies.

Machine Tools in Aircraft Production, by R. R. Nolan; Pitman Publishing Corporation, New York, 1941; 158 pages, $1.50.

Maps and the Weather

Another unit in the text series, *Flight*, in which the fundamentals of aviation are presented, this work presents primary studies of meteorology, map-making and map-reading, aerial photography and its application to cartography, airways marking, radio aids to avigation and a study of aircraft instruments.

The meterology section is extremely simple, opening with a study of the air ocean, its composition, characteristics and functions, and followed by an examination of the thermatic actions, major and minor circulation. Moisture in the air in its various forms—clouds, their characteristics and precipitation—are studied as well as the principles of weather forecasting. The making and interpretation of weather maps and the use of the airway weather service are also presented in simplified form.

The section on aviation cartography introduces the elementary principles of map-making and applies this primary knowledge to the reading of airway maps and charts. Probably because of the close union between aerial photography and map-making, this portion precedes a comprehensive study of the elements of aerial photography and the manner in which it is applied to the making of strip maps.

Cartography is further interpreted by explaining the man-made characteristics indicated on the map, the airway markers and illuminations as well as the radio aids to avigation. Airway lights and markers, marked and lighted airways and standard equipment for this purpose are presented. The radio phase of the communication system, airplane and ground equipment and their use are treated in detail along with the integrated system of radio ranges and linked ground communication. The book is concluded with a review of currently used avigation, aircraft and engine instruments.

Flight—Meteorology and Aircraft Instruments, by Bailey Wright, W. E. Dyer and Rex Martin; American Technical Society, Chicago, 1942; 348 pages, $3.25.

Commentary on Air War

The changes in military and naval operations which have been made by new air tactics in the European war are clearly described in *War in the Air*, which is, in effect, a history of the Royal Air Force in combat. The author traces the origins of the independent service in England and relates some of the controversies which have affected its status, such as the turning over to the British Navy of airplanes operating with the fleet and the Coastal Command.

Each phase of the present war is considered from the standpoint of air warfare. The special duties of each branch of the R.A.F. are outlined and the effects of these operations are given. In a concluding chapter, the author gives some suggestions as to how he believes the United States can best help England to win the war. He revives the old controversy which General Pershing had in the last war with the French and British commands as to whether our troops should operate independently or under foreign command.

Again, it is suggested that our air forces operate within the "framework" of the British Air Force as the Polish, Czech and French squadrons are doing. His own belief is that we can help more by keeping out of formal participation but keeping up the flow of aircraft and pilots to Britain.

War in the Air, by David Garnett; Doubleday, Doran & Company, Inc., New York, 1941; 292 pages, $3.50.

Maps and Aerial Photo Reading

In the last war an American general officer once said "To win this war we must teach our men to shoot accurately and our officers and noncommissioned officers how to read and use maps." Modern warfare has added to this the interpretation and use of aerial photographs. As most tactical movements must be planned from and based upon maps and aerial photographs an ability to read and to readily grasp all information with military significance is of the greatest importance to the officer and enlisted personnel of a modern army.

Map and Aerial Photo Reading Simplified, by Lt. Colonel W. F. Heavey, offers an elementary treatment of the subject for the student with no previous background or experience in map reading. The purpose of the book, according to the author, is to present the subject so that the student, regardless of previous educational qualifications, may with reasonable effort become a quick and accurate reader of maps.

The book opens with an introductory chapter on signs and symbols used in marking a military map. This is followed by a chapter on location and coordinates showing the use of the grid system and coordinate cards. There are chapters on time and distance, direction and azimuths, including the use of the mil azimuth circle and the relationship of azimuths, as well as orientation, elevation and relief, and map reading in the field. The section on reading aerial photographs covers types of photographs, orientation, photo coordinate cards, scales, stereoscopic study, together with sample photographs for study and special problems.

While the text is in the severely condensed form of a military manual, its clarity and liberal use of both illustration and sample problems will recommend it for many defense classes in which map study is necessarily a basic part of the curricula.

Map and Aerial Photo Reading Simplified, by Lt. Colonel W. F. Heavey; The Military Service Publishing Company, Harrisburg, Pa., 1941; 88 pages, $1.00.

BOOKS YOU'LL NEED

Aircraft Engine Maintenance
By D. J. BRIMM, U.S.N.R., and H. E. BOGGESS, U.S.N.R.
Cloth, 479 pp., 500 illus., $2.50 Pub. 1939

Aircraft Maintenance
By D. J. BRIMM, U.S.N.R., and H. E. BOGGESS, U.S.N.R.
Cloth, 512 pp., 700 illus., $2.50 Pub. 1940

Aircraft Blueprint Reading
By H. V. ALMEN, Douglas Aircraft Co., and R. K. MEAD, Lockheed Aircraft Corporation
Cloth, 127 pp., $1.00 Published 1940

Aircraft Mechanic's Pocket Manual
By J. A. ASHKOUTI
Grumman Aircraft Corp.
Cloth, 160 pp., illus., $1.50 Pub. 1941

Practical Mathematics Of Aviation
By A. E DOWNER
Cass Technical High School
Cloth, 124 pp., $1.00 Published 1939

Aircraft Sheet Metal Work
By H. E. BOGGESS, U.S.N.R.
Cloth, 128 pp., illus., $1.00 Pub. 1941

Aircraft Inspection Methods
By N. C. BARTHOLOMEW
Curtiss-Wright Corporation
Cloth, 138 pp., illus., $1.25 Pub. 1940

The Aircraft Propeller
By R. MARKEY
Vought-Sikorsky Aircraft
Cloth, 166 pp., illus., $1.50 Pub. 1940

Elementary Aerodynamics
By Group Capt. D. C. M. HUME
R.A.F. Canada
Cloth, 144 pp., illus., $1.50 Pub. 1941

Machine Tools in Aircraft
By R. R. NOLAN
Northrop Aircraft, Inc.
Cloth, 166 pp., illus., $1.50 Pub. 1941

PITMAN PublishingCorp.
2 WEST 45th ST. NEW YORK

Incendiary Warfare

The use of fire as a military weapon is almost as old as warfare. Before the introduction of gunpowder, this author points out, direct fire projectiles of various types were common, but the appearance of ordnance relegated incendiary devices to a subordinate place for many centuries.

The appearance of the airplane and dirigible during the first World War brought with it the incendiary bomb in various forms, because the air-borne vehicle could distribute the fire bomb with greater effectiveness. In this work, the construction and power of various types of early incendiaries are described.

Before attempting to go into the mechanics of these projectiles, a primary explanation of the physics and chemistry of the incendiaries is given. This is followed by a discussion of the characteristics of the oils, metals and other chemicals commonly used for this purpose, sodium, potassium, magnesium, aluminum, and common combinations such as thermite.

This study is then applied to the theory and practice of bomb construction and chemical fire control as applied to the task of minimizing the effect of modern fire bombs under current war conditions.

Fire From the Air, by J. Enrique Zannetti; Columbia University Press, New York, 1941; 55 pages, $0.50.

Geometry in Aircraft Design

The practical application of descriptive geometry to the problem of aircraft design and manufacture is presented in this work for a reading audience of designers, engineers and loftsmen. It presents the direct method of approach, that of drawing directly from the object by visualization.

Taking for granted that his audience is familiar with principle, auxiliary and oblique views, the author treats them in the briefest possible form, devoting the major part of the work to lines, planes, curves and intersections.

All of the problems of this text are modern and taken from current work and methods. The book is Volume One in a series, and deals with explanations of principles and exercises for acquiring skill and mastering the technique. Volume 2, not as yet published, is to present practical methods for applying analytical geometry to the airplane.

Aircraft Descriptive Geometry, by Walter Vaughn, Aircraft Publishing Co., Glendale, Cal.; 1941, 161 pages, $3.00.

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CIVIL DEFENSE
C. W. Glover, 1941—$16.50
Over 900 Pages. Fully Illustrated, Revised and Enlarged
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So important has this book become to the defense of Britain that this is its 3rd revision in order to keep abreast of the most recent and most successful methods in the science of protection.

WARTIME BUILDING CONSTRUCTION
1st American Edition, 1941
$4.00

This book reviews the general principles of wartime building. It stresses the degree of fire protection required and the best means of carrying out the work.

There is a special section devoted to the construction of single story buildings to provide living quarters for armed forces, also for temporary office accommodations and hospitals.

AVIATION INSTRUMENT MANUAL
1941—$5.00

This publication describes the construction, use and maintenance of instruments, used in aeroplanes and of instruments used on the ground associated with those in aeroplanes.

Also Technical Books in Spanish and Portuguese

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Chemical Publishing Co., Inc.
234D King St., Brooklyn, N. Y.

Air Power Review

The keynote of this book, and the need for works like it is sounded in the introduction, which was written by Col. G. deFreest Larner, who states that there is a sober need on the part of the average citizen for an unemotional understanding of the airplane as a weapon.

The author, an official of United Air Lines, has spent a large part of his aeronautical career presenting aviation to the lay public in one form or another. His book follows the traditional pattern of dissecting the problem, examining its parts, then reassembling it and watching it operate. This principle is applied by the author to the discussion of air power and its direct effect on the average citizen today.

The unit of air power is divided, according to the book, into three components—combat crews, properly trained and in adequate numbers, aircraft of proper quality and in sufficient quantity and variety for the tasks at hand, and air bases suitably located and equipped with adequate personnel and facilities. The function of all three components is outlined, particular attention being given to the various types of airplanes needed for modern warfare and their functions in combat.

Something of the philosophy behind tactics is outlined along with a simplified explanation of important information as to the effectiveness of certain types of bombs, the methods for combating specific types of air attack and the virtues and weaknesses of certain types of Allied and Axis aircraft.

Naval warfare and its effect on the blockade system, modern innovations such as air-borne infantry, paratroops, glider-tow transports and parachute mines are explained in everyday English. The book closes with a short survey on U.S. air strength and its position relative to the present conflict. A large part of the information in this work is conveyed by the illustrations, some in color, painted by Barry Bart.

War in the Air, by John B. Walker, Random House, New York; 1941, 74 pages, $1.00.

Plane dropping stick of bombs
Martin Maryland dropping a salvo of bombs
Best way to score a hit is to 'straddle' target with a stick of bombs.
Direction of plane
Direction of plane
By failing to straddle target bomber failed to damage objective
PATTERN BOMBING
In bombing an important objective, planes cross it in several prearranged directions. Six planes are used here.
In cold, dense air (offering higher resistance) bomb may fall short of objective.
In warm, rarefied air (offering lower resistance) bomb may fall beyond objective.
These pictures illustrate some aspects of bombing technique.

Some aspects of modern bombing technique. From *War in the Air,* by John B. Walker. Published by Random House, New York.

Encyclopedic Aid to Engineers

A two-volume reference work for engineers has been published in the form of an encyclopedia which supplies such practical and useful information as the various important mechanical laws, rules and principles. It covers physical properties and compositions of a large variety of materials used in engineering practice. The characteristic features and functions of different types of machine tools and other equipment are included.

The 4,500 topics in the work are alphabetically arranged and cross-indexed for convenient reference. They have been selected on the basis of their usefulness in the mechanical industries.

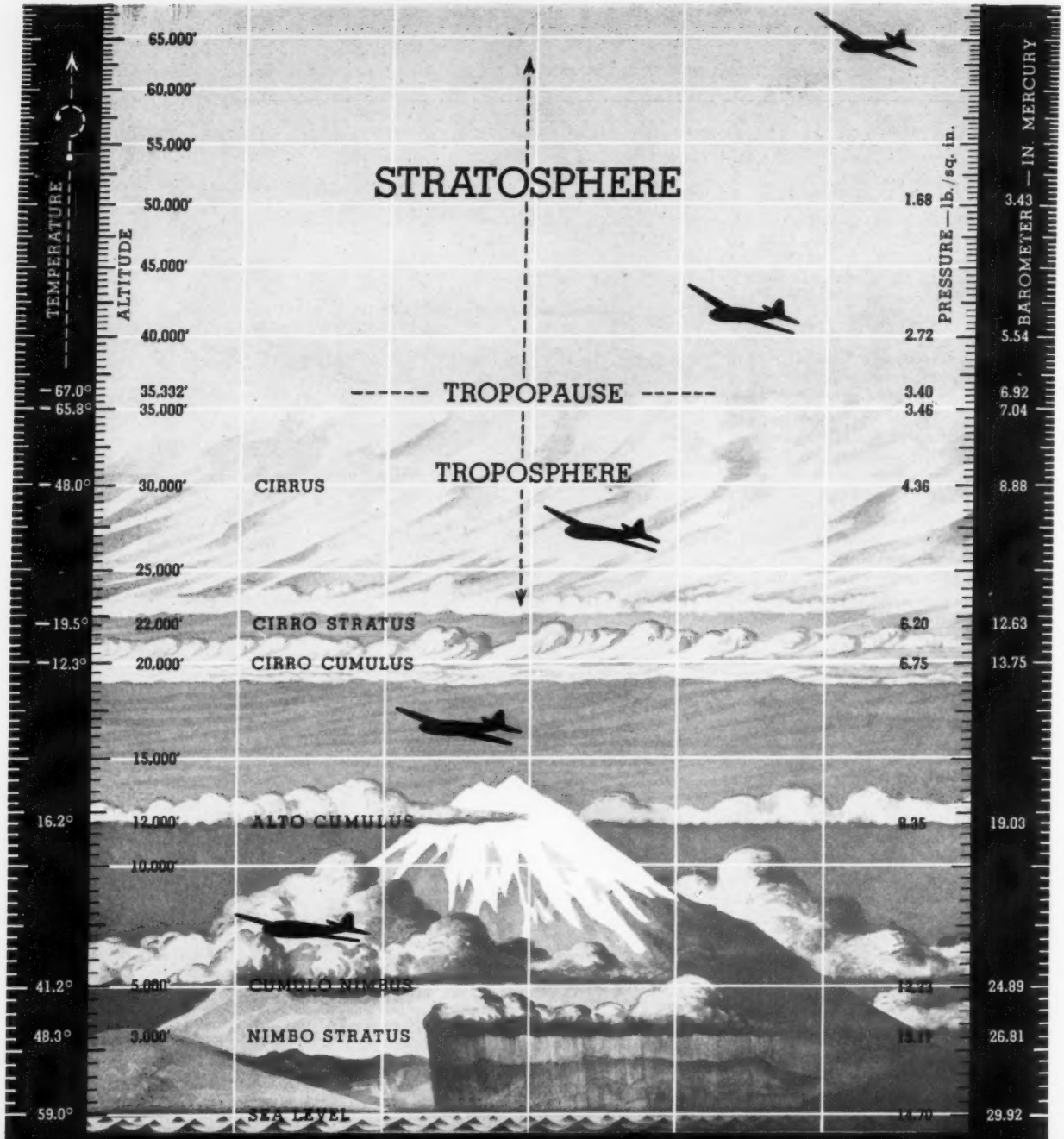
Engineering Encyclopedia, Volumes I and II, edited by F. D. Jones, The Industrial Press, New York, 1941; 1,431 pages, $8.00.

Diary of a German Pilot

Whether this work is authentic or the product of a skillful propagandist is a matter of opinion. It purports to be the cleaned-up version of the diary of a typical German sergeant-pilot who was shot down in battle and transported to Canada for incarceration for the duration. The book indicates neither brilliance in style nor opinion, reflecting the thoughts of a very ordinary person who accepts most of the ideas his officialdom presents to him, absorbing them and making them his personal creed.

Of technical interest is the inadvertent description of the meticulous and scientific organization of the *Luftwaffe* whose planning and executive skill appear to be the key to its success. While no portion of the book is devoted to this, the tone of all operational description seems to indicate the chess-pawn attitude that all the *Luftwaffe* personnel seem to accept as a matter of course, and the implicit faith that the non-commissioned and lower-ranking officers in the general staff seem to have.

I Was a Nazi Flier, by Gottfried Leske; The Dial Press, New York, 1941; 351 pages, $2.50.



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Flight into the Future

The author, one of the pioneer constructors of aircraft in England, describes in this book what he calls the slip-wing type of airplane which he has designed. His aim is to use high wing loadings which are possible when assisted take-off is used. The high-speed bomber has an auxiliary airplane unit attached to its upper surface which, after take-off, can be released so that the lower component can fly with very small wing surface.

In the early part of the book is the history of the aerodynamical developments in airplane design. Aircraft with assisted take-off can use wing-loading up to 98 lbs. per sq. ft. The great advantages are recounted. Descriptions are given of other methods of utilizing the same principle, such as the Mayo Composite, refueling and the scrap wing.

"P.B.," as the author is known to aeronautical people in England, is always provocative as well as interesting in his writings. He is given credit for starting the investigation, while he was a member of the House of Commons, which led to the organization of the Royal Air Force as an independent branch of British defense.

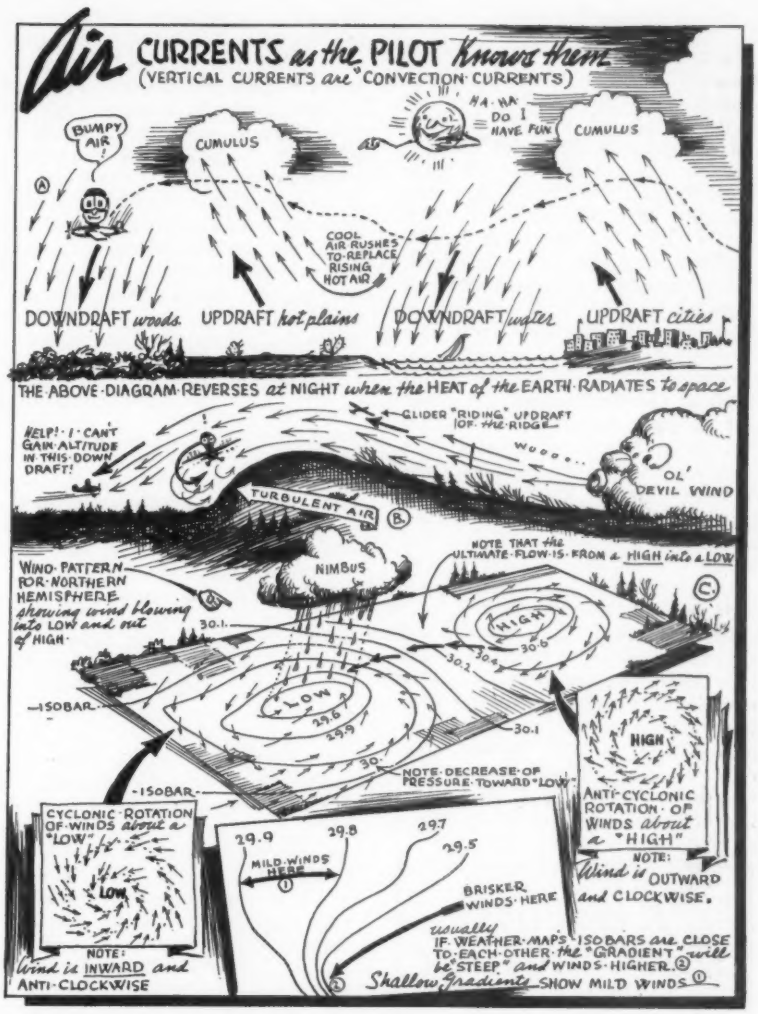
The Aeroplane of Tomorrow, by Noel Pemberton-Billing; Robert Hale Ltd., London, 1941; 307 pages, 12*s.* 6*d.*

Another Flight Primer

An easy-reading volume on the art of flying, written in the language that an instructor might use to a not-too-bright cadet, this book opens with a simple description of the ordinary training airplane, explaining briefly why and how it flies. Using a conversational style, it carries the reader through the student's first ride in the trainer, his primary instruction, his solo and advanced training in both land and seaplanes, and furnishes a cursory view of the elements of avigation, meteorology, and military flying.

While the book itself is not different from most of the good flight primers, being limited by the Civil Aeronautics Authority's Instructor's manual, its section on engine maintenance is particularly worthy of note. Instead of trying to provide a digest of engine manuals, it offers simple, sound suggestions on the care and running of power plants, giving general rules for operation in the same good-humored style as the summary of flying instruction.

33 Lessons in Flying, by Jay D. Blaufox; Coward-McCann, Inc., New York, 1941; 319 pages, $2.50.


Air CURRENTS as the PILOT knows them
(VERTICAL CURRENTS are "CONVECTION CURRENTS)
BUMPY AIR!
CUMULUS
HA-HA DO I HAVE FUN
CUMULUS
COOL AIR RUSHES TO REPLACE RISING HOT AIR
DOWNDRAFT woods
UPDRAFT hot plains
DOWNDRAFT water
UPDRAFT cities
THE ABOVE DIAGRAM REVERSES at NIGHT when the HEAT of the EARTH RADIATES to space
HELP! I CAN'T GAIN ALTITUDE IN THIS DOWN DRAFT!
GLIDER "RIDING" UPDRAFT OF THE RIDGE
Wuoo...
OL' DEVIL WIND
TURBULENT AIR
NOTE THAT the ULTIMATE FLOW IS FROM a HIGH into a LOW
WIND PATTERN FOR NORTHERN HEMISPHERE showing wind blowing into LOW and out of HIGH
NIMBUS
HIGH
LOW
ISOBAR
NOTE: DECREASE OF PRESSURE TOWARD "LOW"
CYCLONIC ROTATION OF WINDS about a "LOW"
NOTE: Wind is INWARD and ANTI-CLOCKWISE
MILD WINDS HERE
BRISKER WINDS HERE
ANTI-CYCLONIC ROTATION OF WINDS about a "HIGH"
NOTE: Wind is OUTWARD and CLOCKWISE.
usually IF WEATHER MAPS ISOBARS are CLOSE TO EACH OTHER the "GRADIENT" will be "STEEP" and WINDS HIGHER
Shallow Gradients SHOW MILD WINDS

An illustration from Eric Sloane's book *Clouds, Air and Wind,* published by the Devin-Adair Company, New York.

Simplified Meteorology in Pictures

As the science of meteorology grows, its interpretation tends to become increasingly complicated. It is therefore an uncommon approach to the problem to attempt to simplify weather observation and interpretation without sacrificing scientific accuracy. Using chiefly the vehicle of his paintings and cartoons, Eric Sloane, who has made a career of interpreting the sky and cloud formations in terms of aeronautical art, tells a simplified story of meteorological phenomena and presents a pilot's conception of the elements.

He goes from a general study of cloud families, their general shapes and the altitudes they inhabit to a closer examination of each cloud formation, its origin and characteristics. Reproductions of his paintings, usually an air view of a modern airplane cutting through a formation of the cloud described, illustrate the text. A primary explanation of weather phenomena, the instruments used in measuring them and the information thus gathered in weather forecasting is illustrated by drawings. The simple directions given for reading the weather map are also an aid to the embryo pilot.

The preface to this work was written by Sverre Petterssen. The author-artist introduces in this work a technique known as *dynamic symmetry,* the science of placing the moving component of the picture, in this case the airplane, in such a position as to create the illusion of motion. His authoritative interpretations in painting are derived from flights during which he makes notes and preliminary drawings of actual atmospheric conditions while his wife pilots the craft on these expeditions.

Clouds, Air and Wind, by Eric Sloane; The Devin-Adair Company, New York, 1941; 76 pages, $2.50.

Sleeve Bearings

An addition to the many practical industrial guides and manuals recently published is this new Handbook intended to aid the engineer, designer and draftsman in the design and application of sleeve bearings and bushings both plain and flanged, full round and split. The information compiled here is founded on successful modern practice in an institution highly specialized in the design and manufacture of sleeve bearings.

In view of the wide diversity of plain bearing applications, no attempt has been made to discuss and describe in detail all conceivable types of bearings and bushings, principles of lubrication and design of associated parts. The work has been confined to specifically selective matters which have been found of major importance in setting up practical bearing specifications and which have shown satisfactory performance and economy commensurate with the performance expected.

Improvements in the performance of sleeve bearings are to be found in new type more recently developed. The more important of these are described in the precision insert, or more changeable bearing, a split bearing made either of steel or bronze back to such fine tolerances that no reaming, boring, or otherwise fitting is required at assembly. A counterpart of this bearing, except that it is full round rather than split, is the precision Dualoy bearing, which requires no sizing or fitting operations after it is properly pressed into its housing. It is made with a steel back in combination with a variety of lining materials.

New everyday bearing materials such as certain cadmium alloys and copper-lead combinations have been developed which will give heavier rods the highest speeds. Twin base and high lead babbitt bearings have been improved, particularly with respect to the fabrication of these materials into bearings and defining the conditions under which they should be applied and used.

Lubrication requirements, including oil clearance, oil grooving, and lubricant distribution within the bearing are better understood, says the author, and material improvement in bearing performance is the result.

This instructive manual treats the subject in several sections comprising successively materials of bearing construction, the precision insert split bearing, oil grooving, special types of split sleeve bearings manufactured by Federal-Mogul Corporation and shims for adjustment of bearing clearance.

An appendix consuming more than half the book gives definitions and explanations of terms used in sleeve bearing design. It discusses identification tests and the etching of twin base babbitt bearings, and presents engine data and specifications required for engine main and connecting rod bearing analysis. It deals in detail with the calculation of absolute viscosity "Z" in the expression Zn/P and with fusible plugs for termination of bearing temperature.

Other appendix sections provide dimension sheets pertaining to precision insert split bearings; plain and doubled flanged split bearings; babbitt lined bearings; precision Dualoy full round plain and flanged steel back bearings; flanged bronze bushings with stock in bore for finishing to size after assembly.

Handbook of Sleeve Bearings, by Albert B. Willi; Federal-Mogul Corporation, Detroit, 1941; 258 pages.

Sheet Metal Reference Book

Recognizing that the rapid changes in aircraft fabrication methods that have taken place in the entire industry may mystify even veteran factory hands, this text on modern airplane sheet metal work begins at the genesis of this modern skilled trade. Factory organization and the various departments are explained briefly with the function of each in relation to the integrated problem of building and assembling a completed airframe. The general divisions of sheet metal personnel and the definitions and terminology common to their craft and to the entire business are presented.

The work concerns itself with the actual process of construction, starting with the mock-up, and explaining all the latest methods of lofting and construction in actual current use. The structure of the typical modern all-metal airplane is studied in the light of methods used to transmute it from mock-up into metal. This includes an examination of the uses of hydraulic presses and the Guerin process, as well as the handling and treatment of special aircraft alloys. Riveting, forming, welding, and the use of press brakes and dies are also discussed.

The appendix includes tables in common use, such as belt speeds, circular measure, effect of heat on various substances and the like. A thorough study of heat treatment of ferrous alloys is also provided.

Airplane Sheet Metal Construction, by Wm. L. Baudette and Donald Schulz; Institute Press, Gardena, California, 1941; 129 pages, $2.00.

High School Aviation Text

This secondary school text on flight and general aeronautics was written in collaboration by an airline captain and a pilot-teacher. It indicates a real understanding of the audience, its capacity and its way of thinking. This is evident in the fact that the usual order of presentation is reversed, and the subject in which most teen-aged students are interested is introduced first—how to fly. The discussion of flying is broken down into the primary motions of the airplane. Then the combinations are woven into the actual technique of safe airplane operation.

Still assuming that readers of the book are neither engineers nor mathematicians, the authors present the elements of aerodynamics, including a simplification of its primary mathematics. The problems of modern avigation are likewise given a simple but thorough treatment.

Meteorology in this work is treated strictly from the airman's point of view. While a certain amount of strictly academic meteorology is to be found, the bulk is devoted to that part of meteorology which directly affects flying.

The last section of the study gathers up loose ends, furnishing an introduction to instruments and instrument flying, weather reporting, air law, traffic rules and other general information.

Elements of Aeronautics, by Captain Francis Pope and Arthur S. Otis; World Book Company, Yonkers-on-Hudson, 1941; 660 pages, $3.40.

Aircraft Engineering
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The Technical and Scientific Aeronautical Monthly
Edited by
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Aircraft Drafting

This text on drafting used in the designing of aircraft assumes that there is no basic difference between this and any other kind of graphic description. For this reason it describes the equipment used in general drafting and explaints its usage. The book differs from the conventional volume only in that it introduces certain of the modern innovations which have been encouraged by progressive engineering methods in which aviation has been a leader. The usual drafting subjects are discussed—basic geometrical drawing, lettering, and multiple, auxiliary and sectional view drawings, and freehand sketches.

The aeronautical material in the text is accumulated bit-by-bit throughout the study of drafting principles, and receives a fullsome treatment in the remainder of the book as general aeronautical terms are introduced. All of the practical problems given in the work are applications from modern, currently constructed aircraft; fastenings and details, full components and special sheet-metal practice are introduced along with power plants, special sub-assemblies, etc.

A special chapter is devoted to the creation of graphic charts, and their application to engineering. The final section of the book furnishes a compilation of data and reference material on computations of weights, clearances for wrench movements, composition of alloys and similar figures.

A Manual of Aircraft Drafting, by Carl Lars Svensen; D. Van Nostrand Company, New York; 272 pages, $2.75.

Welder's Handbook

Written for experienced welders, this reference volume presents the proper welding process for particular metals under various circumstances. In addition to recommending processes, the writer suggests the best filler metal for each process and describes specialized welding techniques not in common use.

The metals, the welding background of which is presented, include aluminum and its alloys, beryllium copper, Dowmetal, Nicral, chrome-molybdenum, steel and other aircraft metals, as well as those common to other industries.

In the appendix, data are given for calculating electrode and gas welding rod consumption for different types of welds. Forms are suggested for comparative welding record sheets for tabulating figures to determine the best welding method for specific tasks.

Welding Procedures; Air Reduction Company, New York, 1941; 54 pages, $0.60.

Book Notes

Tally-Ho, by Arthur Gerald Donahue; The Macmillan Company, New York, 1941; 190 pages, $2.50.

A simple, reserved account by an American farm-boy of his own experiences as an R.A.F. pilot officer.

Lessons in Arc Welding; The Lincoln Electric Company, Cleveland, 1941; 176 pages, $0.50.

Sixty lessons in the elements and practice of electric arc welding.

A.S.M.E. Mechanical Catalogue and Directory, 1942; The American Society of Mechanical Engineers, 1941; 537 pages, $3.00.

A general mechanical directory containing catalogue descriptions of several hundred items used by industry in manufacturing products and maintaining plants, a directory indicating the source of equipment machinery and supplies, an alphabetical list of trade names and an insert catalogue supplying information about A.S.M.E. codes, standards, periodicals and miscellaneous publications issued by the A.S.M.E.

Fundamentals of Aircraft Drafting, by Robert Brydon, Jr.; Delgado Trade Schools, New Orleans, 1941; 71 pages, $1.00.

Textbook for a specialized course in the fundamentals of drawing primary structures of aircraft with some characteristic details, designed to be related to other aeronautical courses.

Through Engineering Eyes, by Allan R. Cullimore; Pitman Publishing Corporation, New York, 1941; 166 pages, $1.00.

Selections from the world's great literature concerning science and engineering.

Municipalities and Airport Zoning; Report No. 145 of the American Municipal Association, Chicago, 1941; 19 pages, $0.50.

A discussion of the relations between airports and municipalities. Various methods of airport control are examined.

A Yank in the R.A.F., by Harlan Thomas; Random House, New York, 1941; 246 pages, $2.00.

A novel about an American ferry pilot who joins the R.A.F. and acts as his squadron commander's rival for the attention of a dancer from the United States. The story is climaxed at the evacuation from Dunkerque.

Library Accessions

Le Renseignement Aerien Sauvegarde des Armées (Aerial Information for the Safety of the Army), by General Armengaud; Librairie Aeronautique, Paris, 1934; 221 pages.

History of French, British, and German reconnaissance aviation during the World War.

Das Segelflugzeug (The Glider), by W. V. Langsdorff; J. F. Lehmanns Muenchen, 1931; 230 pages.

History and development of gliding including descriptions and constructional details of many types of gliders.

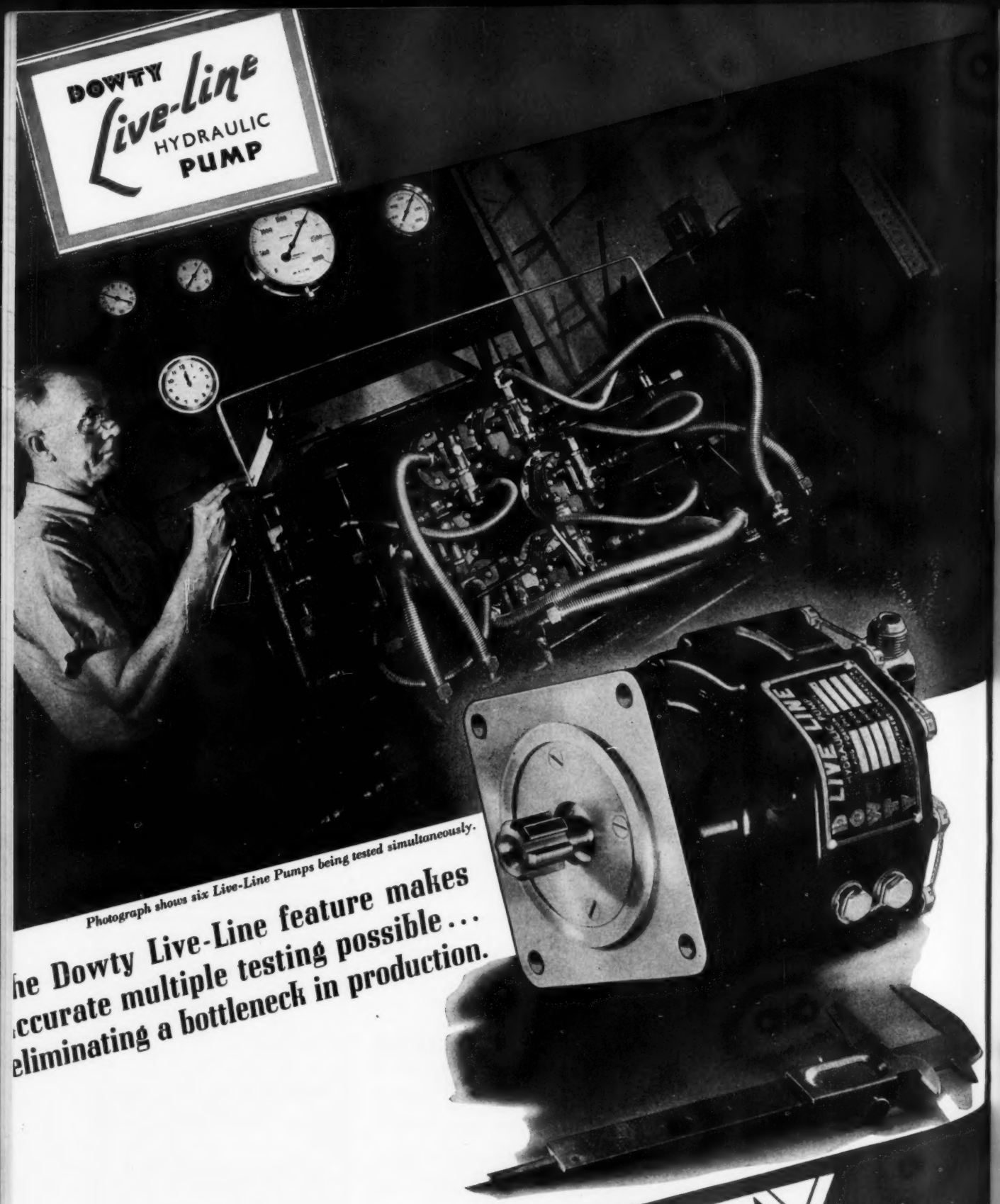
Financing Municipal Airport Operation; Report No. 143 of The American Municipal Association, Chicago, 1940; 53 pages.

The financing of airport operation and maintenance is the subject matter of this fourth in a series of reports on municipal airport problems.

Report of the Air Survey Committee, No. 2; The War Office, H. M. Stationery Office, London, 1936; 183 pages.

The second report issued by the Air Survey Committee details the committee's progress in the study of the problems of mapping inaccessible areas and determining heights and contours from air photographs.

(*Continued on page 60*)



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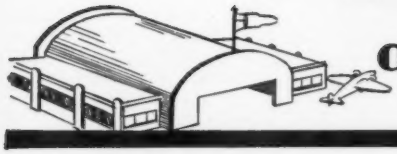
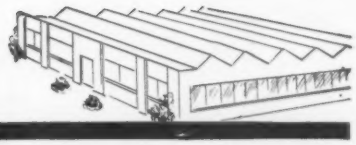




Propeller Handbook

Curtiss Electric Propeller. An operational booklet of 30 pages on the Curtiss electrical propeller. A brief outline is given of the history and requirements of present-day propellers. The principle of operation of the modern electrically-motivated propeller is presented, along with pilot instructions for its most efficient operation. The unit's construction and assembly are described and the booklet is concluded with a glossary of propeller terms. *Curtiss-Wright Corporation, Propeller Division.*

Machining Aids

Cutting and Grinding Compounds. A booklet of 20 pages, reviewing 53 different formulas for machining ferrous and non-ferrous metals with specially designed cutting lubricants and grinding coolants. The formulas cover a wide range of machining operations such as light broaching, drilling, reaming, planing, slotting, wet grinding, cold sawing, light threading and tapping.

Data on several related subjects are also given. These include drawing and stamping compounds, rust-proofing iron and steel parts between manufacturing operations, cleaning, cutting and grinding solution tanks and lines, preparing surfaces of steel products for finishing and similar material. *Oakite Products, Inc.*

Diemaking at Bell

Formfitting the Airacobra. A photographic explanation of the method used by Bell Aircraft's pattern and diemaking department in the making of Kirksite dies used in the stamping of light alloy parts. The pictures show the process progressively from the time the original contour is taken from the mock-up, through the plaster die stage, to the foundry, where the die is cast in Kirksite and, in turn, acts as the mold for the lead punch. *The Bellringer,* November.

Compressed Gases

Magic Bottles. A 20-page survey of the functions of compressed gases in aviation. The use of carbon dioxide as a fire-extinguishing agent is not new in this field. But, modern military applications, such as the rapid inflation of rubber life rafts, flotation gear, etc., have given compressed gas equipment new significance.

This brochure describes some of the newer uses resulting from compressed gas research. Applications are noted for improved oxygen equipment such as non-shattering tanks and vapor dilution systems which render fuel systems explosion-proof. *Walter Kidde & Company,* New York.

Tool Catalogue

Airplane Tools. A revised catalogue of 18 pages, presenting electric and pneumatic tools for aircraft construction and maintenance. The listing includes various types of slow and fast-hitting rivet hammers, single impact riveters and such specialized tools as corner and compression riveters, stationary and yoke riveters, planishing irons, nut runners, grinders, pneumatic screw drivers, etc. Safety balancers and the compressors and accessories required for the maintenance of these tools are also listed. Specifications and application tables for many of these tools are given along with general descriptions. *Chicago Pneumatic Tool Company.*

Welding Equipment

A recent bulletin from *Weltronic Corporation* introduces its line of resistance welder heat-controls, synchronizers and synchronous timers and power and control units for welding equipment and automatic machinery. Descriptions of the individual units are given with data on the application of welding controls. Among new resistance welding control developments presented are an automatic preselective heat rise control, a control providing automatic heat regulation for each electrode on multiple-electrode welding machines and for individual pulsations in pulsation welding.

Stop Nut Catalogue

A descriptive catalogue of 59 pages explains the working principle of the elastic stop nut and how the incorporation of a fibre collar in the head into which the thread of the entering bolt is impressed eliminates the axial play and maintains the required pressure on the load-carrying sides of the bolt and nut threads.

Test data are given for a conventional fastening, a steel castellated nut and cotter pin, and the elastic stop nut. After almost 325 hours of vibration, the conventional fastening showed considerable loosening, while the stop nut assembly showed no effect after 800 hours of vibration.

General directions for applying stop nuts and descriptions of special fittings and nuts for specific purposes are accompanied by sectional drawings and specifications for all the Elastic Stop Nut products. *Elastic Stop Nut Corporation.*

Picture of an Industry

Specialists in Tubing. The development of the Sumerill Tubing Company in a specialized field is described briefly with notes on their products and their uses in aircraft components and instruments and in other fields. *Steel Horizons,* vol. III, no. 5.

Aircraft Bronze

Ampco Metal in Aircraft. A descriptive folder on the variety of uses of bronze in modern aircraft construction. A breakdown is given of those aircraft components in which aluminum bronze alloys are used. A list of parallel specifications of aircraft bronzes furnishes the Federal, Navy, Army, AMS and company designations for the various bronze alloys in general aircraft use. *Ampco Metals, Inc.,* Milwaukee.

Precision Subcontracting

Sperry and Subcontracting. Thomas A. Morgan. The president of The Sperry Corporation outlines the history of his company's present subcontracting system. The parent organization and the subsidiary companies started giving out educational orders in 1936, training smaller machine shops in the art of producing parts to suit Sperry's rigid specifications.

The writer describes the general procedure in accepting a new subcontractor, getting him started on the job, solving with him the problems of unfamiliar procurement and production and frequently aiding him in the training of personnel. *Sperryscope,* November.

"WE WERE TALKING ABOUT AIRCRAFT INSTRUMENTS"

. . . and as I explained to this young cadet in primary training, "There's a big difference. Just like the difference between a cheap watch and a Swiss masterpiece.

"Now take my experience, for example," I went on to make the point . . .

"I learned to fly with a compass and altimeter that fell in the one buck ticker class.

"That was okeh for fair weather, but in this business you take it as it comes.

"So I always said if I bought a plane for myself, I'd wait until I could get what I wanted.

"Then I joined the Army. Man, it was just like having a silver spoon stuck in your mouth so far as equipment is concerned. Nothing but the finest."

The young fellow pointed to the instrument panel on his training plane.

"Kollsman," I said and he nodded.

"In this man's Army you learn to fly, navigate, patrol, fight, bomb with precision instruments . . . and you need the kind you can depend on to take it in action.

"You'll get into some tight spots before and after you get your wings.

"But you'll always get home if you learn to read your instruments.

"*These* babies tell the truth."

KOLLSMAN
AIRCRAFT INSTRUMENTS
Division of
SQUARE D COMPANY
ELMHURST, NEW YORK • GLENDALE, CALIFORNIA
DETROIT, MICHIGAN

APPROVED FOR MILITARY AIRCRAFT

CIRCUIT BREAKER AND "ON AND OFF" SWITCH COMBINED IN NEW SQUARE D UNIT

Pictured actual size
Weight: 2½ ounces
Available in a range of electrical ratings of:
10 amps 25 amps
15 amps 35 amps
20 amps 50 amps
at 24 V.D.C.

IN multiple jobs performed, space required, weight and simplicity of installation, Square D's new combination Circuit Breaker and "On and Off" Switch—with positive, snap action—offers many important advantages for aircraft operation. This Circuit Breaker (Class 9300) is non-trip free—that is, it may be held closed for emergency . . but when released, if over-current is still present, the toggle lever will snap to the "off" position.

Here are some of the advantages

1. It eliminates fuse box and fuses; saves weight and expense.

2. It eliminates replacement of fuses on overload or short circuit and the necessity of having new fuses on hand.

3. It eliminates wiring from pilot compartment to fuse boxes, saving in weight and installation cost.

4. It combines "on and off" switch with circuit protection, thus eliminating switches. *Non-trip free*, the unit can be held closed manually for emergency.

5. It gives time-limit protection for small overloads which are not maintained, and instantaneous protection on high overloads or short circuits.

6. It gives complete control in pilot compartment and resetting can be quickly accomplished after overload is eliminated. Nothing to be replaced.

7. It can be tested for operation without destroying the protection means.

8. It can be installed without changing usual mounting plates, and is easily interchangeable with present type toggle switches.

MAY WE INTRODUCE OURSELVES?

To many men in aviation, the Square D Company may be a new name. But in the industrial and construction fields, it is recognized as one of the largest manufacturers of electrical control equipment and the leader in the production of Circuit Breakers (several hundred thousand Square D units are in use today).

Out of this great wealth of manufacturing experience, coupled with that of our Kollsman Aircraft Instruments Division, the new combined Circuit Breaker and "On and Off" Switch was designed especially for aircraft operation. After passing extensive tests it has been accepted for use in military aircraft.

SQUARE D COMPANY

Regulator Division, 6060 Rivard St., Detroit, Mich.
Information also available at
Kollsman Instrument Division, Elmhurst, New York • Glendale, California

Avoiding Vertigo in Aerobatics

The Semicircular Canals in Flyers. K. Fuchs. An abstract of an article which appeared in the *Canadian Medical Association Journal*, July 1941, describing the vestabular apparatus of the ear, which permits man to maintain equilibrium in different postures without conscious effort. Aerial acrobatics, according to the article, produce a special series of conditions which make these natural guides to attitude inaccurate.

In aerobatics such as rolls and spins, simulated in the laboratory by a whirling chair which produces frontal or sagittal rotation, the endolymph or liquid in the semi-circular canal of the inner ear continues to whirl after the actual body rotation stops. This gives the pilot the sensation of being whirled violently in the opposite direction. In actual practice, this may result in the pilot going back into a spin from which he has just recovered.

The conclusion points out several positions which the pilot may assume to minimize the effect of the rotation and avoid vertigo in aerobatics. *What's New*, October.

Tool Application Booklet

New Wings for Production. A 14-page picture survey of the use of drill presses, grinders, saws, finishers and jointers made by the Delta Manufacturing Company for modern aircraft production. The illustrations include both examples of the application of stock tools to production jobs at the various plants and the use of special tools built for the accelerated completion of a single operation. *The Delta Mfg. Co.*, Milwaukee.

Douglas Cold Chamber

Cold Is Where You Find It. Don Black. Temperature conditions similar to those at 20,000 to 35,000 ft. can be simulated in the cold chamber recently completed at the Douglas plant, according to this description. Designed by Tom Floyd, the $14' \times 16' \times 8'$ chamber is insulated by spun glass and cooled by dry ice and methyl alcohol and can be reduced to a temperature of $-104°F$.

Special leather suits lined in merino wool and an aluminum helmet which has also been cold-insulated are provided to permit working comfort in the chamber. A summary is given of some of the surprising effects of extreme cold on airplane components such as the peeling away of paint or the rupturing of rubber tubing. *Douglas Airview*, September.

Thermocouple Type Indicator

A catalogue insert sheet describing two thermocouple-type engine cylinder temperature indicators has been issued by the *Lewis Engineering Co.* of Naugatuck, Connecticut. The general use and function of this type of indicator are outlined with an explanation of its operation. Single and dual types of this instrument are described. Three-view drawings and general specifications are given.

Lucite Applications

Solutions to Your Transparent Enclosure Problems. A 16-page booklet describing the fabrication of transparent plastic sections for airplanes. It presents sixteen uses for Lucite methyl methacrylate resin on various sections of many modern airplanes. The physical properties of the plastic are outlined and the potential applications described in detail. *E. I. du Pont de Nemours & Company.*

Welding Aid

Electrode Consumption Calculator. A shortcut to estimating the cost of arc welding electrodes for welding any type of joint on any thickness with bare or coated electrodes is provided in this 8-page folder. The number of pounds of electrodes required per linear foot of weld is indicated. The calculator presented provides consumption figures for both bare and shielded electrodes, and covers all metal thicknesses commonly employed in making all conventional types of welds. The amount of steel deposited per linear foot of weld is also shown, and basic formulas for calculations on joints not shown are included. *Air Reduction Company*, New York.

Lightplane Receivers

An addition to the looseleaf catalogue of the RCA Manufacturing Company describes the AVR 100 and 101 receivers built especially for light aircraft. The main difference between the two units is that the 100 receives both beacon and broadcast, while the 101 receives the beacon band alone. Both sets are built to adapt a directional loop antenna. Specifications and an interconnectional diagram are included in the insert. *Radio Corporation of America.*

New Drill

Hardsteel Drills. A booklet on the application, operation and grinding of a new type of drill which is used to cut hardened steel at high speeds. The new tool can be used to drill, ream, countersink and counterbore, and works with ease in oil-hardened, water-hardened, cyanided and nitrided pieces, high-carbon, high-chrome, and high-speed steels of any degree of hardness. *Black Drill Co.*, Cleveland, Ohio.

Automatic Machinery

Cylinder Heads by the Mile. In the recently opened Cincinnati plant of Wright Aeronautical, the problem of increased production was approached by the use of automatic multiple tools. This article describes the operation of several of these:

The Greenlee automatic transfer machine, replaces 39 standard semi-automatic machines and produces a finished cylinder head every 48 seconds. The Snyder counterboring machine replaces six machines and reduces operational time from 11 minutes to 55 seconds. Another Greenlee machine, used for machining supercharger fronts, cuts production time from 224 minutes to 24 minutes. The Baker multiple drill bores all 38 holes and the center hub of the crankcase nose section. Many other time and labor saving precision machines are used to accelerate production without loss of quality. *Tradewinds*, November.

Electric Tachometer

The new types of electric tachometers built by Kollsman, described in a recently issued pamphlet, incorporate certain design advancements and assure continued supply by the use of domestic bearings in place of certain foreign designs which are no longer available.

The instruments and generators described are the standard single-needle type, which makes $1^3/_4$ revolutions for the full range of 3,500 r.p.m., and the sensitive indicator which has two pointers; the longer one reading in hundreds of r.p.m., the shorter in thousands. The outer rim is graduated in 10 r.p.m. units. Complete operational descriptions, specifications and outline drawings of the tachometers and their generators are provided in this catalogue. *Kollsman Instrument Division, Square D Company.*

Precision Tool Room

Precision Plus. Robert W. Minton. The standardization required for modern aircraft production has made precision tools for airframes necessary for the first time in the history of the industry. Tools built to 0.0001 in. tolerance are constructed in a special air conditioned buildong of Douglas Aircraft Co. The air is changed every six minutes and the temperature is kept constant at 69 to 70 degrees.

This article describes the quiet atmosphere in which 95 per cent of all the machine tool jigs and all the master gages used at the Douglas plant are bored, and the precision machinery which has been installed for this close tolerance work required by modern pressure production. *Douglas Airview*, October.

(Continued on page 61)

From the Industry

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assured by the Aeronautical Review.

Civil Aeronautics Administration

The number of instrument approaches at 88 airports reporting to the airway traffic control service of the Civil Aeronautics Administration has more than tripled between 1939 and 1941, according to Administrator Donald H. Connolly. A total of 7,362 instrument approaches were made at these locations in the first six months of 1941. An instrument approach is a preliminary to a landing under conditions of impaired visibility, and is worked out by the pilots of airline, military or private airplanes along a standard pattern. A definite procedure for each major airport has been established.

Facilities provided by the C.A.A. for these approaches consist of the radio range which guides the pilot along an airway and gives him an identifying signal when he is over the range towers, and marker beacons which permit him to determine his position on the airway. Future plans call for an airport localizing radio beam to enable the pilot to line up with the runway. By proper use of these facilities, and by following the established procedure, the pilot is able to "break out" of the overcast above a field in the proper position for making a landing by sight. Eventually, instrument landing equipment will make possible completion of the landing by instrument alone.

The largest number of instrument approaches for the first half of this year—647—was made at the Chicago airport. There were 560 at Burbank, Calif.; 518 at Pittsburgh; 386 at LaGuardia Field, N. Y.; 379 at Oakland; 374 at Kansas City; and 233 at Washington. Most of these approaches—7,019—were made by airline pilots. The Air Corps accounted for 202, the Navy for 11 and itinerant pilots for 130.

A new wall map, designed especially for use in planning mass training flights, has been prepared by the Flight Information Section of the C.A.A. and will be issued quarterly. Basically, it is a chart of the federal airways system and contains, among other pertinent facts, positions of the navigational aids and data covering every aeronautical radio station in the continental United States, with the exception of airline stations.

This chart is to be used in connection with "Air Navigation Radio Aids," a booklet issued monthly by the C.A.A. in which is tabulated information on minimum safe altitudes for flight, mileages between radio fixes and the location of danger areas. An alphabetical listing of station identifications, a statistical summary of all C.A.A. radio facilities, control airports, airway traffic control centers and telephone numbers of C.A.A. communications and Weather Bureau aerological stations are also included in this publication. While the charts will prove valuable to all fliers, they will be particularly helpful in training student pilots in cross country work.

U.S. Army Air Forces

Flight surgeons from the U.S. Army School of Aviation Medicine at Randolph Field, Texas, presented the results of four separate pieces of scientific investigation before the thirteenth annual meeting of the Aero Medical Association of the United States at Boston, Massachusetts, on November 1. One report on the results of experiments performed during high altitude flights to 20,000 ft. showed the effect of anoxia on electrical systole, duration of electrical activity of the heart ventricles in man as measured on the electrocardiogram.

These experiments consisted in having volunteers not use supplemental oxygen while in Army twin engined bombers and transport planes in ascents to 20,000 ft. Additional subjects were then studied in flights to 15,000 ft. Supplemental oxygen was not used until the peak altitude or the limit of tolerance of the subject was reached.

All these studies were then repeated on the ground simulating high altitude ascent by having the subject use a rebreathing technique. Here the utilized oxygen was replaced by nitrogen.

Comparisons of the subjects in the air and on the ground were correlated with the determinations of the oxygen saturation of blood. In all the experiments performed, the ratio of electrical systole to the pulse rate was prolonged, in contrast to what happens under normal oxygen tensions.

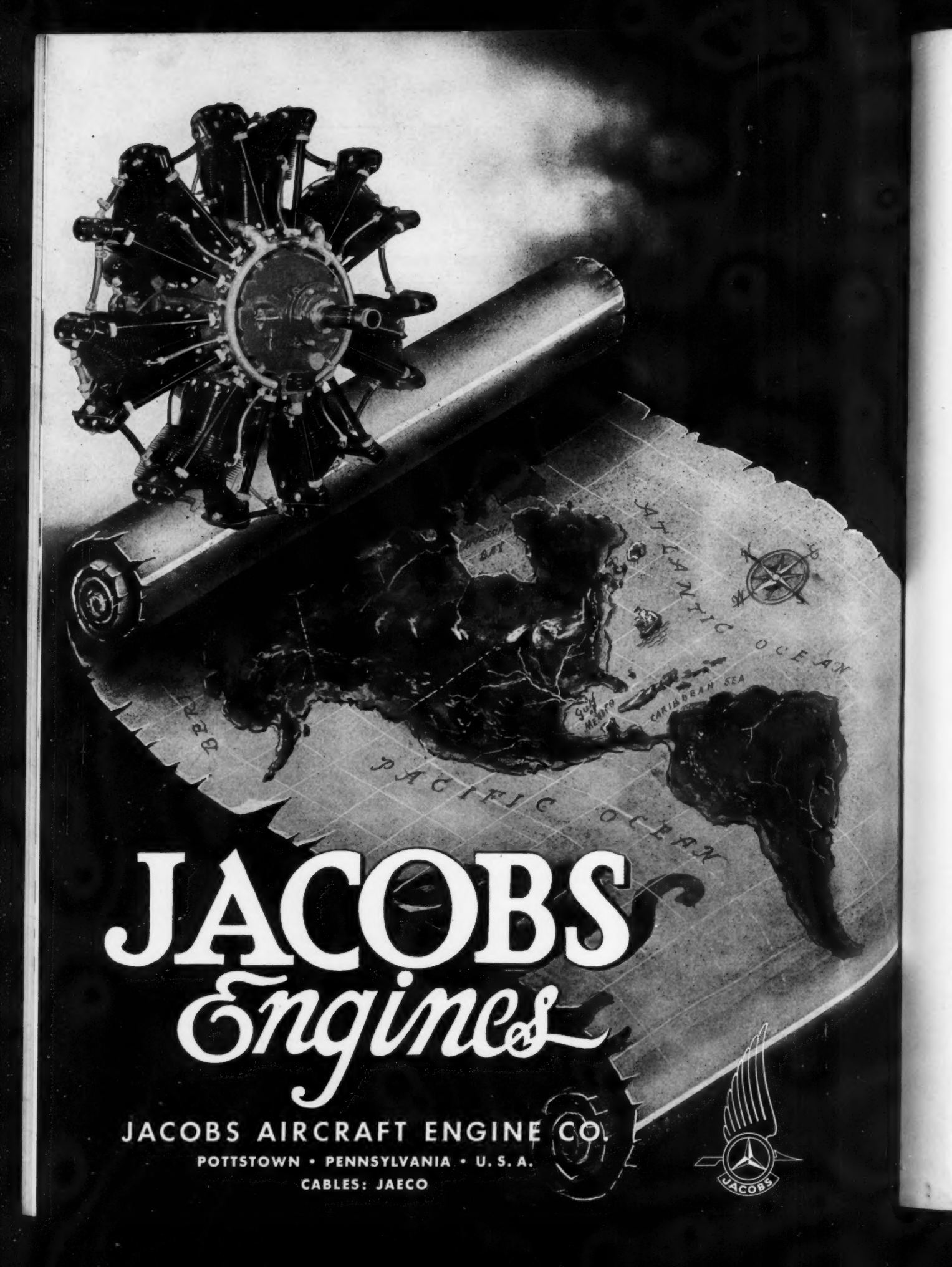
A second paper dealt with the response of the circulation in normal man to acute progressive anoxia produced by rebreathing. The direct venous pressure, the circulation time, the volume of the packed red blood cells (hematocrit), as well as simultaneous observations on arterial blood pressure, pulse rate, respiratory volume and oxygen saturation of the blood were determined.

In all subjects, the circulation time was decreased, in some instances by as much as thirteen seconds, as the oxygen saturation of the ear blood approached 75 per cent (normal saturation 96 per cent). There was no change in the hematocrit determinations during the experiment. The venous pressure showed a variable picture apparently related to other changes in the peripheral circulation and in respiration.

The third paper described the limitations of the electrocardiogram in the physical examination for flying. It was demonstrated that this laboratory method could be misleading if not interpreted by specially trained personnel. Examples of several abnormalities in the records of pilots without organic heart disease were shown, in order to emphasize the fallacy of trying to determine a man's physical fitness to fly from the electrocardiogram alone.

The Department of Otolaryngology presented a paper concerning the effects of flight upon the ears and hearing. Numerous audiograms which have been studied by the department seemed to demonstrate that under certain conditions there may be a notching in a flier's curve of hearing.

This notching may follow long periods of exposure to extreme noise inherent to aircraft flight. If the middle ear is normal and capable of being properly ventilated through the act of swallowing, then only extremely high tones (those in the area of the last note on the piano) are affected because of this noise factor. If the eustachian tube is unable



JACOBS Engines

JACOBS AIRCRAFT ENGINE CO.

POTTSTOWN • PENNSYLVANIA • U. S. A.

CABLES: JAECO

to ventilate the middle ear properly, other tones may become involved. The amount of involvement seems to vary in various individuals. Some fliers with many thousands of hours of flight show perfectly normal ears and hearing. It is believed that heredity, age and previous diseases of the hearing apparatus influence the effect that flight may have upon the ears and hearing.

Delivery of the first AT-11 twin-engine advanced training plane and the service testing by the Army Air Corps of the AT-9 twin-engine advanced training plane were announced recently by the War Department.

The AT-11, a low-wing, all-metal monoplane manufactured by the Beech Aircraft Corporation, Wichita, Kansas, will be used for the specialized training of bombardiers and gunners. It is equipped with flexible guns and bomb racks for training a crew of three or four men, depending upon the instructional mission. It has a wing span of approximately 47 ft., a length of 35 ft., retractable landing gear and twin tail. Power is delivered by two radial, nine-cylinder, 450 hp. Pratt and Whitney engines which operate two two-bladed propellers having a diameter of approximately 8 ft.

Manufactured by the Curtiss-Wright Corporation, the AT-9 is designed for the training of pilots for multi-engine fighters and bombers. The airplane is designed to facilitate the transitional training necessary in the transfer of an Army pilot from single-engine airplanes to the latest types of multi-engine tactical aircraft. It incorporates the same general performance and operating characteristics of the latter types and its equipment includes numerous instruments.

The advanced trainer is an all-metal, low-wing monoplane with retractable landing gear and seats side by side for the instructor and student pilot. It is powered with two 280-hp. radial, air-cooled engines, has a wing span of 40 feet, and weighs more than 5,000 lbs.

Army announcements from Mitchell Field, headquarters of the First Air Force, report successful results on a variety of tests conducted during the recent Carolina maneuvers on the portable airports made of Marsden Strips. They have tested the strips under almost all the conditions they would have to face—in cross winds, on nights when visibility is poor and in wet weather.

It has been found that rain does not make the surface slippery and that the strip is as easy to get into as a regular landing field. In addition they have found that there is less wear on the rubber tires of the landing gear than there is on a concrete runway, and that braking action after the plane has landed is easier than on a regular field.

Almost every type of airplane used by the Air Forces successfully tried out the metal strip in a test conducted by Col. William E. Kepner, commanding officer of the First Air Support Command. Everything from a 65-hp. observation airplane to the consolidated B-24 landed and took off from the portable runway.

Army fighters—P-39's and P-43's, the light attack bombers designated the A-20A's, observation and transport airplanes and the A-24 dive bomber as well as Marine fighters and Navy dive bombers took part in the test. Made of individual steel sheets 10 ft. long and 15 in. wide, hooked together to form a tight, firm landing surface, the runway may be taken apart and transported to any location where it is needed.

In wartime when military airdromes must be scattered and concealed over a wide area, the portable strip would be of particular value. It lends itself well to camouflage and may be made invisible from the air. It might be made to look like a cornfield, or as is being done now in Europe, camouflaged by painting a road through it, and, by the use of shadows, simulating buildings. The use of shadows is of particular importance in minimizing the value of aerial photography.

The Marston Strip installation has been camouflaged to appear like an orchard from the air. Each steel sheet is perforated with large holes which serve to lighten it for transportation purposes without weakening it.

The "mat" has the bearing strength of four inches of concrete, and weighs about 1,000 tons. It was laid in place by the 2nd Battalion, 21st Engineers. Since the operation was a new experience, 11 days were consumed in preparing the ground and laying the sheets in position. During the installation one crew of 75 soldiers achieved a speed of one foot a minute—laying four of the 15-inch strips across the 150-foot wide mat in five minutes. Engineers estimate that experienced crews could lay the strip and complete necessary grading in less than a week.

National Aircraft Standards Committee

Reports from the National Aircraft Standards Committee on its recent annual meeting in New York City indicate that there are wide discrepancies in screws, rivets, accessories and the simplest of parts now used in the manufacture of aircraft.

In normal times, this situation is natural in a new and rapidly developing industry. Production, maintenance and repair, however, tend to become almost hopelessly delayed and confused under wartime conditions in the absence of any concerted effort to achieve the maximum standardization possible.

To meet this need, the National Aircraft Standards Committee, made up of engineering representatives of the principal aircraft manufacturers, has worked unremittingly to reduce the great number of different gages of sheet metals and other stock material, and to bring about a more efficient handling of small parts design with respect to interchangeability. This group works closely with the Army and Navy and the Civil Aeronautics Board, the OPM and the Army-Navy-British Joint Committee so that due consideration is given to all concerned, from suppliers of raw materials to the fighting squadrons abroad.

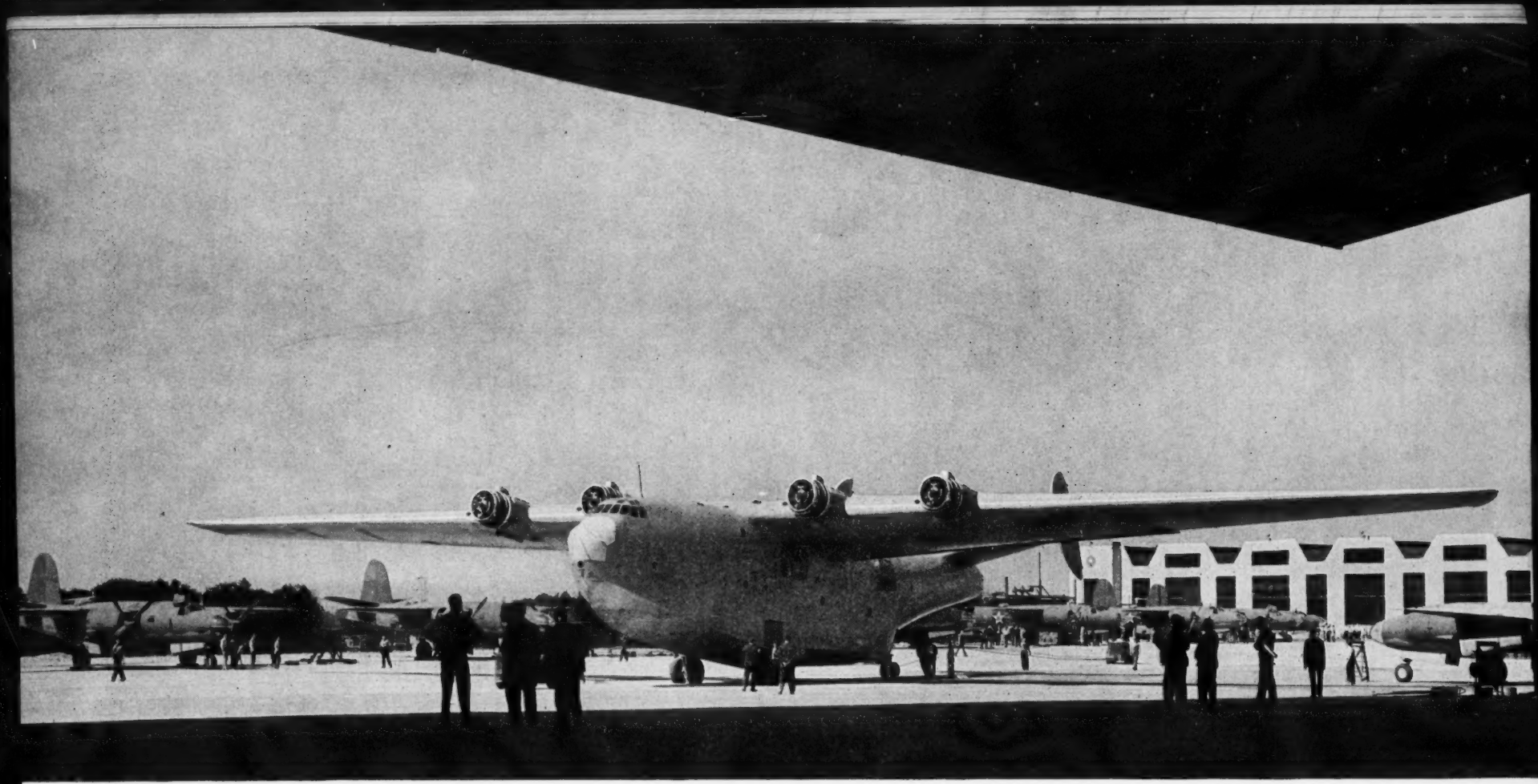
Some of the specific problems considered at the recent annual meeting dealt with recessed-head screws, filleting radius of hollow-head bolts, degree of countersinking of rivets, mounting bases for hydraulic parts and control wheels and pedals.

The group is working toward standardization on the length of the threaded portion of screws and bolts of all kinds. This is most important because there are cases on record of failures due to screws pulling out because of insufficient threading and nuts being stripped on the unthreaded portion of bolts. Recessed-head screws are absolutely indispensable in aircraft work where a slip of the screwdriver may leave a scratch where corrosion can begin or a fracture originate. Yet the types and sizes are so varied that it makes stocking of these screws and the necessary tools a ponderous task.

At present there are half a dozen different degrees of countersinking of rivets commonly encountered in aircraft: 78, 90, 100, 110, 115 and 120 degrees. Actually, only two degrees are required, a deep countersinking for heavy plate and a shallow angle for lighter gages. The committee is now seeking standardization on 78 degrees for the heavier applications, while 100 degrees has been found entirely satisfactory for most applications.

There are a score or more of hydraulic items, pumps, control valves, etc., varying widely in mountings. The group is now working toward standardization on the sizes and spacing of holes in mounting bases so that the similar items of various manufacturers will be interchangeable. Control wheels and foot pedal designs are being standardized around dimensions of an "average man," taking into account his reach, head clearance required and length of limb.

The greatest savings resulting from this standards work is in time. Also important, however, are the many advantages to the military services in field operations and the lowering of unit costs of aircraft.



PREVIEW OF TOMORROW!

THROUGH THE WORLD'S LARGEST DOOR

A TRIBUTE to Martin engineers and workmen was the Navy's order to create the world's largest flying boat. The mighty XPB2M-1 introduces a new era in over-ocean flying. Your Navy, in foreseeing the need for such a plane, displayed the vision which has made American ships . . . both of the sea and of the air . . . second to none. In the XPB2M-1 the Martin Company has done more than give America a great new weapon . . . It has given the world a preview of the even greater flying boats yet to come . . . The Glenn L. Martin Company, Baltimore, Maryland, U. S. A.

Martin
AIRCRAFT

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Aircraft Components

A new type aircraft hose clamp that duplicates the tightening forces exerted in the tying of a piece of string has been announced by Aircraft Components, Inc., Van Nuys, California. Designated the "King-Klamp," the new production accessory departs from the conventional type of clamp which exerts its tightening force in only one direction, perpendicular to the axis of the hose. The King-Klamp tightens through exertion of the gripping forces of a guide and trunnion assembly parallel to the axis of the hose, pulling the clamp from both directions around its circumference the same as when a string is tied around a parcel.

Advantages gained by this new principle are indicated: uniform bearing on the complete circumference of the hose; absence of distortion of the clamp at any point around its own circumference; usable over any number of times after removal in the course of repair work, since no part of the clamp or any point of its circumference is distorted or over-stressed.

It is not necessary, according to the makers, to "pre-load" the tightening unit, as the gripping action responds immediately to the first turn of the thumb screw. The gripping force increases gradually, with no abrupt bind at the point of final required tension. No take-up is sacrificed in performing clamp by constructing the clamp band by hand to fit the O.D. of hose. There is an immediate snug fit of clamp to hose upon first turning the thumb screw.

The King-Klamp is a 360-degree clamp installed by wrapping it around the hose, pressing the facing bosses of the guide and trunnion assembly toward each other by hand, and tightening with a thumb screw. The clamp is made of stainless steel, fabricated by spot welding. All materials and construction details conform to A.N., C.A.A., and S.A.E. specifications. The clamp is available in eight sizes which accommodate all tube diameters from 7/8 in. to 3 in. Other sizes for irregular shapes of hose can be made to specifications.

American Export Airlines

Three huge airplanes built since the war began, and needed to speed transatlantic communications during the present emergency, were shown at Stratford, Connecticut, for the first time on November 12. Addressing a group of newspaper men, Igor, I. Sikorsky, speaking for the designers and builders, said that the craft were engineered with one definite objective—to operate with utmost efficiency over long, over-water routes, at high speed and with full passenger, mail and express loads.

Each airplane will have a top speed of 235 m.p.h. Their cruising speed with full load in long-distance flights will be 175 m.p.h. Maximum non-stop range, under special fuel and load conditions, is figured to be in excess of 6,000 miles.

The streamlined hull, designed for quick take-off, is 80 ft. in length, divided into 12 compartments, in addition to the flight bridge located on an upper deck. Four Pratt & Whitney twin-wasp, air-cooled engines, mounted on the massive cantilever wing which spans 124 ft., deliver 4,800 hp., and these are equipped with full-feathering Hamilton Standard, three-bladed propellers 12 ft. 6 in. in diameter.

Luxurious passenger accommodations reflect many refinements in design. More space is available per passenger than in any other commercial aircraft. As these are the longest-range, non-stop commercial airplanes to be built, special provision has been made to assure utmost comfort for passengers in flight.

Each airplane can be outfitted to accommodate 40 passengers for daytime flying. For non-stop transatlantic service they are equipped with full-size sleeping accommodations for 16 passengers. Separate sleeping and living quarters are available for the crew. Each craft has a complete galley for the preparation of full-course, hot meals in flight. An air-conditioning system of entirely new design, thermostatically controlled, is installed. In addition, each passenger will have a cold air valve subject to his individual control.

Large mail, express and baggage compartments are contained in the wing and amidships in the hull. Radio apparatus designed by American Export Airlines' engineers represents a stride forward in airlines' communications. This includes code and radio telephone equipment, plus an emergency code set. In addition, there is a complete intercommunicating system.

First of the new flying boats is due to be launched and test-flown early in December. Two sister craft will follow within the next few months. The showing occurred on American Export Airlines' Fifth Anniversary. The company holds a certificate from the Civil Aeronautics Board for the New York-Lisbon route.

The Benwood Linze Company

The Benwood Linze Co., St. Louis, Mo., announced recently a new all-purpose portable power rectifier which provides a flexible source of D.C. current supply for testing various types of aircraft and D.C. motors for such operations as flap and retracting landing gear. These units can be used within the aircraft plant or on the runway and aprons with equal facility for airplane engine starting where the voltage requirement does not exceed 12 volts at 300 amperes or 24 volts at 150 amperes.

In this portable power unit there are a three-center-tapped heavy duty transformer and six separate stacks of copper-oxide dry-plate rectifiers, thermo switch controlled by the plate temperature of the rectifier element. This protector switch prevents overload by opening a three-pole main relay which disconnects the A.C. input to the unit.

Other features include a specially designed, automatic, magnetic circuit breaker to protect the entire unit from abnormal overload, variable output voltage which may be manually switched from 12 to 24 volts, and a 16 in. diameter cooling fan which produces 800 lineal feet of air per minute. The unit is designed for 190 to 250 volts, 60 cycle, three phase A.C. input. Similar units with higher voltages and amperages to meet specific requirements on aircraft plants, production line or in testing, research and other departments are also available.

General Electric Company

The installation at Wright Field of two large blowers, 2,000 hp. each, to deliver sufficient cooling air to airplane engine test stands, has been reported by the General Electric Company. The blowers are designed to absorb 20,000,000 B.t.u. per hour, which is equivalent to absorbing the heat output of a ton of coal burning in this length of time.

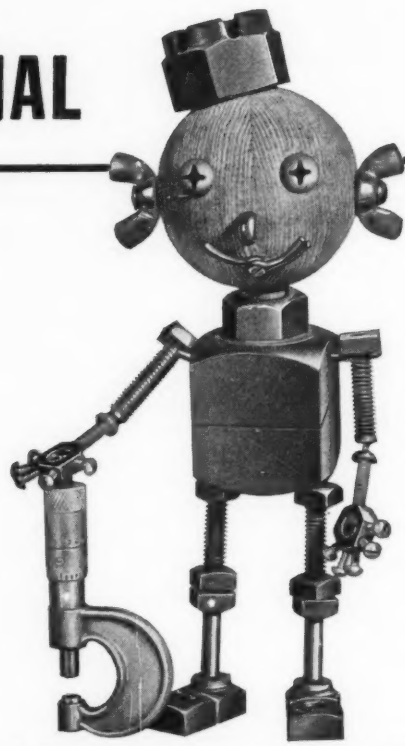
When set up for testing, the airplane engines will be fastened to torque stands, and test propellers attached to furnish load. With this method of testing, all the output of the engines is released into the air in the form of heat. To cool the engines and to get rid of this heat, blowers, installed below the engines, will pull air from outside over the test stands and through an opening in the floor into a concrete tunnel, finally discharging it out-of-doors.

The required air pressure will be maintained in each test stand to keep the engine temperature approximately at one level. To accomplish this, General Electric engineers have developed a control system which functions from a pressure-responsive device. If a change in pressure should occur, this device will react and the motor speed will be varied automatically until the predetermined pressure is reached.

A new 150-ampere direct-current arc welder, the Strikeasy, has been announced by the General Electric Company for use in fabricating bright-surfaced, thin-gage metals, such as aircraft tubing (S.A.E.-4130) which has a

Get Quick Service on Headed and Threaded Product Needs—

USE THE "NATIONAL" ARSENAL



NAT SAYS...

Precision made—
There's no denying
Our products help
To "keep 'em flying."

- *Phillips Recessed Head Screws and Bolts* in carbon steel, nickel steel, brass and other metals
- *Aviation Screws* to the AC and AN specifications in carbon steel, nickel steel and brass
- *Aviation Nuts,* plain, slotted and castle
- *Aviation Wing Nuts,* plain and drilled
- *Aviation Cotters,* regular and corrosion resistant steel
- *Aviation Bolts* • *Aviation Clevis Bolts* • *Aviation Studs*
- *Wood Screws,* steel and brass, Flat—Round—and Oval Head, sizes from No. 0 to No. 24 diameter
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National
HEADED AND THREADED
PRODUCTS

AUTOMATIC SCREW MACHINE WORK AS WELL AS HEADED AND THREADED SPECIAL PARTS TO SPECIFICATIONS

THE NATIONAL SCREW & MANUFACTURING CO., CLEVELAND, OHIO

wall thickness of 35 mils. Based on extensive research and experience, the design and characteristics of the new welder have been especially developed to help operators produce strong, uniform joints quickly and easily without spoilage.

Chief among the important features of the Strikeasy arc welder is its "pep" or extra high instantaneous recovery of voltage (40 to 60 volts) which helps the operator to strike the arc with ease under the difficulties presented by thin metals having a bright, polished surface. Rapid, accurate adjustment of the welding current is also provided by means of a tap switch and a rheostat; the former for speed in getting wide range adjustments, and the latter for accuracy in obtaining the exact number of amperes needed for best results. The wide welding range permits the use of shielded-arc electrodes as large as 3/16 in. in diameter and as small as 3/64 in. in diameter.

As a further aid to the operator in producing welds of uniform strength, the Strikeasy arc welder may be used with a remote-control device for reducing the current when the operator wants to fill a weld crater or when a reduction of heat is needed to avoid burn-through.

The equipment is horizontally mounted to assure efficient lubrication, and to avoid excessive end-thrust on its self-sealed ball-bearings. Cool operation is obtained by means of a fan cooling system, while isothermic relays guard against operation on harmful overloads.

The Strikeasy arc welder is available with or without running gear. Without running gear, the over-all dimensions are: length 28 in., width 13 1/2 in., and height 21 in.; net weight 385 lbs. With running gear, over-all dimensions are: length, 40 in., width, 16 in., and height, 27 in.; weight, 415 lbs. net.

A device for indicating to airplane pilots the intensity of electricity in a nearby thundercloud has been developed in the general engineering laboratory of the General Electric Company. Called a "Cloud Charge Indicator for Airplanes," it is a delicate instrument containing a Neon tube and a micrometer and can be mounted on the panel board of the airplane. The glow of the Neon tube serves as a signal for the airpilot.

The instrument is connected to a pointed tungsten rod, similar in size and shape to a lead pencil and protruding 14 in. from the airplane, preferably at the nose. The rod picks up the electrical discharge from the cloud and sends it through the instrument. This causes the Neon tube to flash and the needle to deflect. The amount of this deflection indicates the intensity of the electrical disturbance and permits the pilot to change or maintain his course accordingly.

In the laboratory, high-voltage and lightning experts rigged up an artificial cloud-plane arrangement. A brass sphere, about two feet in diameter, was suspended a known distance above a tungsten rod which was connected to a "Cloud Charge Indicator." The sphere served as the cloud; the rod, 14 in. high, served as the airplane. Voltages of known magnitudes were passed through the "cloud" and the instrument readings were noted. The voltages, or electrical pressures, per linear foot in the atmosphere, were calculated for any given reading on the instruments. Data also were developed for a 6-in. rod. From this data, charts were prepared that will perform the same function for the pilot of the plane.

Tungsten rods are recommended, it is said, because of the high melting temperature of that metal. The 14-in. rod is preferable to the six-in. rod because less interference is received from the fuselage.

It is suggested that records of the intensities recorded under various atmospheric conditions and at varying heights from the clouds and at various plane speeds will be kept by the airlines using the instruments. This would provide research engineers with additional data for the study of lightning phenomena.

The instrument, consisting of a double-scale microammeter, glow tube, resistors and capacitor, is designed to register up to 400 microamperes. It is contained in a Textolite box 5 1/4 in. high, 3 in. wide and 2 3/8 in. deep. Weight is two pounds. A standard one-half in. airplane coupling 2 1/8 in. long is provided for connections.

Allison Division, General Motors Company

Perfection of a new process for inspection of bonded bearings that will be the means of preventing some of the occasional inexplicable airplane engine failures, commercial as well as military, has been announced by F. C. Kroeger, vice-president of general Motors and general manager of the Allison Division of General Motors. The Allison Division not only manufactures bearings for Allison engines but also for several other aviation and Diesel engines. The Allison development will be made available through the Army Air Corps to such other manufacturers as the Air Corps designates. According to the Allison release, the most exacting control of processes in the manufacture of bearings can minimize the possibility of poor bonding between the bearing surface material and the shell. But until now there has been no means of inspecting the finished part which would guarantee the bearing against possible failure resulting from a poor bond. Destruction of a percentage of the bearings was the only means of measuring the efficiency of the process, and experience has indicated that under the most ideal conditions, approximately one per cent of the production might still be questioned. The development of a foolproof, inexpensive and highly practical way of instantly and positively catching the infinitesimal hidden flaw which might lead to a serious engine failure is said to be of inestimable value.

Allison has received permission from the Air Corps to inspect with the new process as rapidly as possible the bearings in engines now in the hands of airplane manufacturers.

This super-inspection will not materially affect the scheduled production of fighting airplanes in the U.S., Kroeger said. Only one manufacturer, who, considerably ahead of schedule, has used up the stock of Allison engines at that plant, may be forced to curtail completion of some aircraft while engines are being re-inspected. With the present Allison engine production rate, this lag can be taken up in a short time.

Kollsman Instrument Division, Square D Company

A recently announced development of the Kollsman Instrument Division of the Square D Company is an electrical motor for aircraft equipment. It offers low inertia and fast reversal operating characteristics and is called the Drag Cup Motor. It uses the two phase induction drag cup principle with the corresponding lightweight motor and shaft assembly to obtain these operating characteristics.

The motor was originally developed to meet the special requirements for operating the directional loop on aircraft radio direction finders where constant and rapid reversal ability is required. The unit is, however, adaptable to many installations where these operating characteristics are required. Three types of motors are available, each offering a separate series of operating characteristics. Two types operate 400 cycles with 110 volts and 90 volt current source requirements, and one at 60 cycles 110 volts. Two of the units weigh only 11 ounces, the third only 15 ounces.

The Lincoln Electric Company

Improved and simplified design of its system of "Dual Continuous Control" for arc welding machines, eliminating the need for meters showing volts and amperes has been announced by The Lincoln Electric Company, Cleveland, Ohio. These welders have both job

"PEELING OFF" by John Hammer

FIGHTING ACE FOR '42... Republic Aviation, holding to the single objective of developing the ultimate in high-altitude interceptor aircraft for the Army Air Forces, records its newest and most noteworthy achievement—*the P-47 Thunderbolt,* a super-powered plane for a super-fighting job. Republic Aviation Corp., Farmingdale, N. Y.

REPUBLIC AVIATION

REPUBLIC AVIATION

selector and current control, calibrated and equipped with dials which indicate the type of work and the number of amperes for each and every setting. It is claimed that this feature enables the welding operator to secure highest quality welds and highest possible welding speeds because he can vary both the slope of the volt-ampere curve and the amount of welding current independently and positively to suit every job encountered.

Another feature of this welder control is that both voltage control (job selector) and current control are continuous in operation. This design provides literally thousands of possible combinations of voltage and current. This is said to simplify the setting of the control and accounts for an exceptionally wide welding range as to types of work, welding conditions, sizes of electrodes and thicknesses of material. Being continuous, the control can be advanced or retarded in increments as fine as desired.

An important advantage made available by this design is the ability to positively reverse polarity. The location of the reversing switch has been changed to the position formerly occupied by the meter, immediately above and between the self-indicating dials. Settings of the reversing switch for "off," "electrode negative" and "electrode positive" are indicated by markings on a disk attached to the control box.

Patrick McDermott Company

The need for an extra man or helper, when working with nuts and bolts, can frequently be eliminated by the use of the new Lox-On Wrench according to the manufacturers, the Patrick McDermott Company of Los Angeles. Developed for aircraft use, this alloy steel bolt and nut wrench has an inner shaft actuated by turning a hexagonal handle which firmly locks the wrench socket upon the nut. Built in sizes from 1/4 in. to 3/4 in. the Lox-On Wrench is adaptable wherever a box wrench is needed, with the additional locking feature enabling the user to spin nuts on or off without attention to position or need for help to hold the bolt.

Mead Specialties Company

A new type of hold-down clamp for drill press work, said to speed up this type of operation from 30 to 300 per cent has been announced by Mead Specialties Company of Chicago. Known as the *Air Clamp*, it is adapted for use on any drill press having a cylindrical column.

The clamp is quickly attached by means of a divided collar which clamps in any desired position. The working head is mounted on a heavy, horizontal arm which slides in a split boss on the column collar. Two hand levers hold the head in any desired position so that pressure may be applied in any direction and at any point on the work, regardless of size or shape, within the capacity of the drill press.

The *Air Clamp* is operated by means of a two-way valve on the upper left side of the working-head. For certain types of operations in which the drilling-time is short and new work is fed into the fixture rapidly, a foot-control is available.

Quick, detachable hold-down feet of various designs can be used according to the shape of the work, or the ram alone may often be used on large units. When the pressure is released by means of either the hand or foot control, the arm automatically returns to the "top" position, giving ample clearance for removal of the work.

The model shown is designed for use with a line pressure of 40 to 80 lbs. and is suitable for drill presses up to 3/4 in. capacity. Collars to fit drill press columns of various diameters can be furnished. The standard model has a "reach" of about 14 in. from the drill press column, so that the pressure-foot may be brought down behind, on either side of, or practically in front of the chuck. The ram is rotatable in the cylinder so that the pressure-foot may be swung full 360°, providing an almost unlimited variety of positions.

An important feature of the *Air Clamp* is the instant ease with which it can be set for various operations. Drilling-jigs can be reduced to the simplest forms and built-in clamps and hold-downs can be eliminated. The time and money saved by this fact alone may run into astonishing figures. Production is increased and operator fatigue is reduced. Due to *Air Clamp's* constant flexible pressure, variations in thickness of the work (frequently a source of trouble with castings) cause no difficulty or delay.

Morrow Aircraft Company

A plastic-bonded wooden military type training airplane, developed expressly for civilian flight schools was test-flown recently by veteran pilot Vance Breese. It incorporates many new methods of fabricating and molding wood, some never before used in the aircraft field. Progressive steps of production and assembly of the Morrow Victory trainer are as follows:

Laminated wood bulkhead rings, plastic-bonded with the new type resin glues, are set in jigs, to which spruce stringers are attached longitudinally. Over the fuselage, stringers are attached with resin glue. They run from the engine fire wall to the tail, the fuselage skin consisting of inner and outer molded sections of plywood. The entire skin for the fuselage consists of but two halves—and carries part of the stresses. No rivets or bolts are required, and when given its finishing paint, the fuselage surface is glass-smooth.

The full-cantilever wing consists of a continuous section, to which the fuselage and outer wing tips are bolted. A resin bonded, box-type wood spar runs from one end of the wing to the other at the rear of the wing, to which are attached the flaps and the ailerons. The front spar extends only from the landing gear on one side to the opposite side. Ribs are constructed of a solid plywood web with laminated caps and stiffeners, giving extreme rigidity. Covering of the wing and the tail surfaces is of plastic-bonded plywood, attached to the stiffeners and ribs with resin glue. Like the fuselage, the wings and tail surfaces are free from rivets or other protruding fastening devices and when finished present a glass-like surface.

Tail surfaces are constructed and finished in the same manner as the wing. Landing gear is of the hydraulic retractable type, folding in toward the fuselage. A hand pump, located in each cockpit, raises or lowers the landing gear in six seconds, through hydraulic pressure created by the hand pumps operating retracting cylinders on each leg of the landing gear.

Brakes on the wheels are hydraulically operated by toe-type pedals integral with the rudder pedals. A special development by the hydraulics department of the Morrow Aircraft Corp. is a hydraulic brake lock, which performs the same function as a parking brake in a car, and is standard equipment in their Victory Trainers. Cockpit enclosures are a permanent part of the airplane, formed from Plexiglas and Lucite over the laminated bulkhead rings. Doors are provided at each cockpit for easy access with quick releasing latches. Engine mount is constructed of welded tubular steel, and rubber vibration dampeners support the six-cylinder, horizontally opposed, 175 hp. Lycoming engine.

The Morrow organization developed their special processes for forming and molding the plastic-bonded plywood after many months of study and research. The molded plywood is virtually fire-resistant, impervious to water or oil, and at the same time is highly resistant to shock and impact. A feature of particular importance is the ease of maintenance and repair, which does not require special machinery or skill on the part of the mechanic.

The reduction of surface friction to a minimum, through the avoidance of rivets with their attendant drag, has added over 25 m.p.h. to the performance

We're proud to help keep 'em flying

Back in 1903 Socony-Vacuum's Aviation Products earned their wings—on Wright Brothers first flight. And ever since that great day at Kitty Hawk, they have been firmly established favorites with aviators everywhere.

Each step of the way, from those early bamboo and baling wire days to 1942's trim light planes and powerful dive bombers—Socony-Vacuum has kept pace with aviation development. Experience in meeting increasingly exact demands for top efficiency gasoline and oil has resulted in today's Aero Mobilgas and Aero Mobiloil. Socony-Vacuum is proud of their reputation and their place in modern aviation.

SOCONY-VACUUM OIL COMPANY, INC.
AVIATION DEPARTMENT

26 BROADWAY **NEW YORK, N. Y.**

of the plane over any other ship of the same horsepower. Thus the high speed and performance desired in secondary trainers are achieved without excessive power, which reduces initial investment and operation costs.

The Victory Trainer has a wing span of 30 ft. 4 in., an over-all length of 25 ft. 4 in., a height of 7 ft. 9 in., and a weight empty of 1,656 lbs. Payload consists of two pilots, parachutes, gasoline and oil for a maximum of 1,000 miles range, and the necessary flight and radio instruments. Top speed is in excess of 165 m.p.h., with a cruising speed at $^2/_3$ power output of 145 m.p.h. Landing speed with flaps up is 70 m.p.h., with flaps down 55 m.p.h.

Standard equipment in the Morrow Victory Trainer includes hydraulically operated retractable landing gear, using specially-designed Morrow hand pump, oleo shock struts, and hydraulic brakes; hydraulically operated split flaps; complete sets of Kollsman flight instruments on shock-mounted instrument panels in both cockpits; adjustable rudder pedals; Morrow hydraulic brake locks; Ranger receiver and transmitter in rear cockpit only; and hand fire extinguisher.

Owens-Corning Fiberglas Corporation

Construction of effective sound stacks for the absorption of noises set up by airplane engines and propellers while they are being tested presents a number of problems which in the case of several new sound stack installations, have been attacked recently by the use of Fiberglas thermal insulating wool as the sound absorbing material, according to Owens-Corning Fiberglas Corp. releases. Among installations in which this material has been used for sound absorption purposes are the sound stacks at Patterson Field, Dayton, Ohio; the naval air bases at Cavite, P.I.; and the Midway Islands.

Sound stacks are regarded as much more than research gadgets. They are necessities because modern airplane engines are so highly powered that under testing they develop intense noise vibrations. Moreover, they are needed to prevent deafness among workers and annoyance to nearby residents.

A test stand for aircraft engines usually consists of a test cell in which the engine is mounted, a control room directly connected to the test cell, and two sound stacks through which air enters and leaves the cell. The sound stacks serve to admit and discharge air put in motion at high velocity by the engine propeller, and, at the same time, must absorb a large percentage of the noises generated by the engine and propeller in action.

The stacks may be above the test cell, or they may be at the test cell level. One typical installation employs vertical sound stacks about 40 ft. high with a 20-ft. square opening. In each stack space is provided for 15 sound absorbing panels, each measuring 20 by 20 ft. A horizontal stack about 30 ft. deep with a 45-ft. square opening provides space for 33 sound absorbing panels, each 45 by 24 ft.

The requirements for the sound absorbing material used in the stacks are varied and exacting, but laboratory tests have demonstrated the fact that Fiberglas thermal insulating wool meets

Interior view of the inlet stack of the engine test cell at Patterson Field near Dayton, Ohio, looking up through the stack from the test cell floor. This shows how Fiberglas bats, installed between perforated metal sheets, are used to muffle the roar of engines on the test stands.

all of them. The usual practice is to install bats of the Fiberglas insulating material between perforated metal sheets in the form of pans or other similar units. The pans are installed as baffle plates. Exact methods of assembly, details of the size and disposition of the perforations, spacing of the panels, etc., are all matters within the control of the designer.

Tinnerman Products, Inc.

New flat-anchor type Speed Nuts have recently been manufactured for blind mounting and flush-blind mounting assemblies. They offer many advantages in savings of cost and assembly time and weigh only 20 per cent as much as conventional fastenings of similar application.

These Speed Nuts are designed with a ball formation surrounding the prongs of the Speed Nut that is sufficient to span the standard dimpling for countersunk flat head screws or bolts.

Designed with floating U-type Speed Nuts snapped over an aluminum carrying-ring, this new assembly device has proved faster and lighter for the attachment of Aircraft landing lights, hand hole plates and access doors.

Former method employed forged aluminum rings or channels with "lock" nuts attached. This Speed Nut-carrying ring may be riveted to a doubler plate or other structures and the desired degree of "float" can be governed by the size of the holes over which the Speed Nuts fit.

Tradefilms, Inc.

Two films, *The Engineer's Relation to Production* and *The Engineer's Relation to Assembly* have been announced by Tradefilms, Inc., which prepared the films in collaboration with the Lockheed Aircraft Corp. Other topics on riveting, blueprint reading, various forms of welding, aircraft shop equipment, and jigs and fixtures are among the subjects scheduled to be issued in the future.

Each item consists of a strip of 35 mm. film which is projected in any of the standard machines designed for such work. These will undoubtedly be familiar to those who have made use of the lectures prepared by the Institute of the Aeronautical Sciences for the Student Branches. Accompanying each film strip is a commercial type phonograph record on which is transcribed the descriptive text and discussion of each picture. Following the presentation of each item, a bell sounds as a part of the recording, giving the operator his cue to turn to the next picture. The records are of the large size used in radio broadcasting and are designed to be played on a phonograph having a turntable speed of $33^1/_3$ r.p.m.

The outstanding and most significant fact about the material on "Production" and "Assembly" is that these topics were produced with unusually fine cooperation between the film manufacturers and their aeronautical advisers. The whole tone of both films, the selection of pictures and the discussions accompanying them give the impression of complete understanding of the problems at hand. This definitely authoritative quality of the presentation should do much to awaken and hold the students' interest.

As to the general method of treatment, there are times when the pictures follow too closely upon one another and the student does not have sufficient time to fully appreciate the significance of each item. However, the instructor may, of course, show the films without the vocal record and discuss each frame in detail so that this is not a particularly serious point.

The "Production" film begins with a brief outline of what might be termed

(*Continued on page 49*)

NO. 9

ALUMINUM, DEFENSE, AND YOU

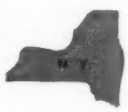
ALCOA

SIX MORE PLANTS IN FIVE STATES ON THE WAY

DEFENSE PLANT CORPORATION OWNS THEM. We've been designated to build them . . . fast.

Actually, when the names went on the dotted lines of the contract on August 19, we had already placed more than $16,000,000 worth of orders for some of the equipment and materials it takes longest to make and get.

FIVE OF THESE PLANTS will smelt aluminum. Their combined capacity is planned for more than 500,000,000 pounds a year, which is greater than the nation's entire production of aluminum in 1940. Locations: Massena, N. Y., Spokane, Wash., Troutdale, Ore., Los Angeles, and in the State of Arkansas.



The sixth plant will refine alumina from bauxite. Its billion-pounds-a-year capacity adds 58% to the nation's alumina capacity. It will be located at Bauxite, Arkansas.

HOW GOES CONSTRUCTION? At this writing, as fast as title is secured to the sites, contracts are being let for grading and foundations so as to be ready for the structural steel, which is coming as rapidly as it can be gotten.

What is more important, the aluminum plants are scheduled to deliver ingot by the summer of 1942; the refining plant to deliver alumina in early summer, 1942.

WE'VE ASSIGNED a large staff of men full time to headquarters engineering, purchasing, and accounting on this government building job.

We're sending competent and experienced management men out on these jobs as superintendents and other staff executives on construction, and for subsequent operation of such of these plants as we are designated to operate.

EVERY KNOWN IMPROVEMENT in design and construction and equipment is being incorporated in these plants. We intend that every dollar that will be spent shall be the best dollar's worth that experience can build. We do not make one cent of profit from this assigned job of construction.

We think we know how to get the government value-received for its money, because we are completing the expenditure of more than $200,000,000 of our own money in an expansion program which started after the beginning of the present war. Some of this expenditure is in new alumina and aluminum plants which will bring our own Alcoa capacity up to more than 700,000,000 pounds a year. The remainder is in tremendous expansion of facilities for fabricating every form of aluminum.

DEFENSE, GENTLEMEN, is getting its aluminum.

ALUMINUM COMPANY OF AMERICA

From the Industry

(*Continued from page 47*)

'What Every Young Aeronautical Engineer Should Know." The problems facing him in the transition from classroom to industry are touched upon, the main theme then being brought out that airplane parts must be designed so that they can be produced in the shop in an economical manner. Making drawings which are completely understandable to the shop and the significance of tolerances in design are discussed. Designing so as to reduce the cost of fabrication is next considered. Types of machines and equipment used in the manufacture of aircraft parts are then shown. These pictures include sheet metal tools as well as the many types used for making machined parts. In each case the capabilities and limitations of the machine are pointed out. The film closes with a final emphasis on the basic principles of production design.

In the "Assembly" film, a similar method of presenting the subject is employed. Following a brief introduction discussing the relation of assembly to cost and design, a discussion of jigs and their function is taken up. Here again the proper use of tolerances and their relation to assembly and design are considered. A number of pictures is devoted to the subjects of detail, major and final assemblies and the advantages of extensive use of small sub-assemblies is strongly emphasized. Methods of assembly by riveting and welding are treated extensively and the best methods are clearly shown. Some miscellaneous topics such as painting, corrosion protection and maintenance and a final emphasis on high speed production methods of assembly bring the film to a close.

These two films in themselves represent extremely valuable contributions to aeronautical engineering education. It is believed that the visual-vocal method of education in general and the films on "Production" and "Assembly" in particular should do much toward improving and rounding out the present training programs in aeronautical engineering.

United Air Lines

Making possible the elimination of windshield icing and unobstructed forward vision, a new-type double windshield is being installed on all United Air Lines' Mainliners following 18 months of development and test work, according to announcement of J. A. Herlihy, executive vice-president in charge of United's operations.

The windshield consists of a front pane of quarter-inch safety plate glass and a rear pane of eighth-inch transparent plastic, with a quarter-inch air space separating the two. Air, heated to 175°, passes through a duct from the airplane's cabin heating system and on through the air space of the windshield, then through an exhaust duct to the outside of the craft. The air, controllable by the captain through the operation of a valve at his elbow, moves at the rate of 60 cu. ft. per minute.

In installing the double windshield, 10 by 35 in., on the captain's side of each pilot compartment, United is removing the small vertical post which has been standard between the large fixed panel and small sliding panel of the DC-3 windshield, thereby affording the captain unobstructed forward vision.

Herlihy said that the engineers tested fluids, windshield wipers, the application of heat to the inside of the windshield and another arrangement of a double windshield before deciding on the system now being installed.

Wittek Manufacturing Company

A new hose clamp, designed for aircraft use was announced recently by the Wittek Manufacturing Company of Chicago. The new clamp, Type FB consists of a stainless steel band welded with four spots at the nut. A floating bridge is incorporated to eliminate friction, strain and buckling of the hose. This also permits the use of a torque indicating wrench, so that all clamps can be tightened uniformly.

The clamps tighten with a 1/4 to 28 thumbscrew, the end of which is riveted to the bridge, so that the bridge retracts as the screw is loosened, and the clamp returns to its original size. The thumbscrew head is punched for safety wire.

The Wilbur & Williams Company

Recent low-temperature laboratory tests have shown an amount of contraction sufficient to cause actual separation of the metal fuselage from the camouflage paint with which it was covered. The Wilbur & Williams Company of Boston, Mass., offers a solution for this difficulty in their rust-preventive paint, Totrust, which retains its elasticity through a temperature-range from 100°F. below zero to 800°F. above zero.

Several years of service as an inner and outer coating for containers in which dry ice is shipped, have proved that Totrust maintains its elasticity at temperatures as low as those encountered in the stratosphere. Totrust has long since proved its value as a rust-preventive. It contains a vehicle of great capillary power, which gives it unusual penetrative properties.

Government Publications

(*Continued from page 23*)

The Vibration and Sound of a Revolving Thin Plate. Juichi Obata, Yahei Yosida and Yasuo Makita. This report describes part of an investigation of propeller flutter. This section summarizes an attempt to study the acoustical characteristics of flutter by means of model propellers. While the small sized propeller models could not be turned fast enough to produce flutter, sections of thin, uniform plate could be spun to produce a phenomenon acoustically resembling actual propeller flutter.

The flexural and torsional vibration, sound pitch and flutter of various sizes of thin plates were studied and recorded. It was determined that the vibrations were in all cases torsional and that no bending vibrations were observed. *Report No. 206 of the Aeronautical Research Institute, Tokyo Imperial University*, April 1941.

On the Theory of Turbulent Boundary Layer on a Flat Plate. Tatudiro Sasaki. The writer proposes a mean vortex theory in which the turbulence is considered to be composed of very fine vortices. These vortices decay or grow, but in a very small region their mean strength is not altered, and it is a function of space. The velocity distribution in a turbulent boundary layer is governed by the distribution of mean vortices. *Report No. 211 of the Aeronautical Research Institute, Tokyo Imperial University*, August 1941.

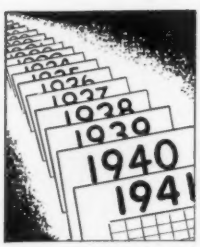
The Coupling of the Propeller Blade Bending Vibration With the Crankshaft Twisting Vibration of a V-type Engine. K. Tanaka and T. Ohino. A report of a theoretical examination of this problem and of numerical calculations made with actual datum of an 800 hp. V-type engine and its propeller. The study was based on the assumption that the sectional area and moments of inertia of the blade are in linear relation with its length.

From the study, it was found that in an actual case, with couplings of the propeller with the crankshaft, there are natural frequencies not only due to the crankshaft twisting vibration but also to the propeller bending vibration, the former being the same as that in which the propeller blade is assumed to be a rigid body. *Report No. 212 of the Aeronautical Research Institute, Tokyo Imperial University*, August 1941.

USE THIS GREAT FUND OF PLASTICS EXPERIENCE

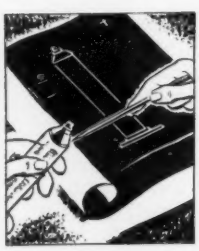
in meeting rigid government and industrial specifications

UTILIZE KNOWLEDGE AND EXPERIENCE OF BAKELITE PLASTICS HEADQUARTERS BASED ON MANY YEARS' CO-OPERATION WITH INDUSTRY AND GOVERNMENT



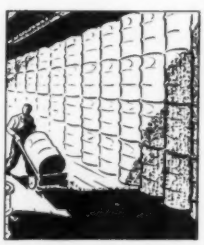
1 MANY YEARS' EXPERIENCE: Many plants are today employing plastics for essential items. To these concerns, Bakelite Plastics Headquarters offers its assistance in meeting exacting government and industrial standards and specifications. Plastics Headquarters is well qualified to help engineering groups in finding the answers to such important questions as the right plastic to use and the correct method of fabrication.

2 FIELD SERVICE REPRESENTATIVES: To assist manufacturers in using plastics correctly, Bakelite Plastics Headquarters maintains a staff of Field Service Representatives. These men are plastics specialists. Long years of experience qualify them to study conditions prevailing in an individual plant, and determine how existing equipment and personnel can be used most effectively to obtain the desired results.



3 ADVISORY TECHNICAL STAFF: By investigation, study, and analysis of a specific plastics application, the Bakelite Advisory Technical Staff is often able to offer ideas and suggestions that will simplify design, speed production, cut costs, and improve product performance. It welcomes the opportunity to submit recommendations that will assure the many savings which the use of plastics makes possible.

4 LABORATORY AND TESTING FACILITIES: Whether manufacturers wish to improve production methods, or seek ways and means of testing plastic products to determine their fitness for service, they may obtain the full co-operation of the Bakelite Development Laboratories. The services of technologists are also available for improving existing plastic products or developing new formulas for specialized applications.



5 HUNDREDS OF "BAKELITE" PLASTICS: The large number of BAKELITE materials available enables manufacturers to select the proper plastic for each application. These include Phenolic, Urea, Cellulose-Acetate, and Polystyrene molding materials; laminating varnishes; cast resins; oil-soluble resins; plybond adhesives; air-drying and heat-reactive coatings; bonding resins; impregnating and calendering materials.

6 PRINTED LITERATURE: Helpful technical booklets containing detailed information on BAKELITE Plastics are available without charge. These booklets cover such subjects as BAKELITE molding materials; heat-reactive varnishes for making laminated plastic materials; cast resins; oil-soluble resins for paints and varnishes; plywood bonding materials; and other types for specific industrial needs.

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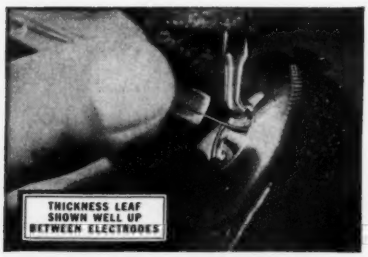

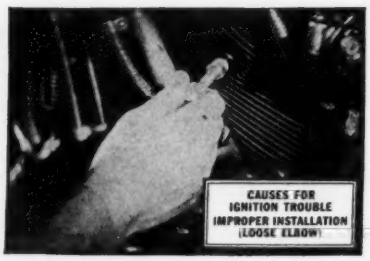

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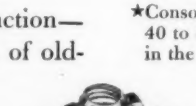

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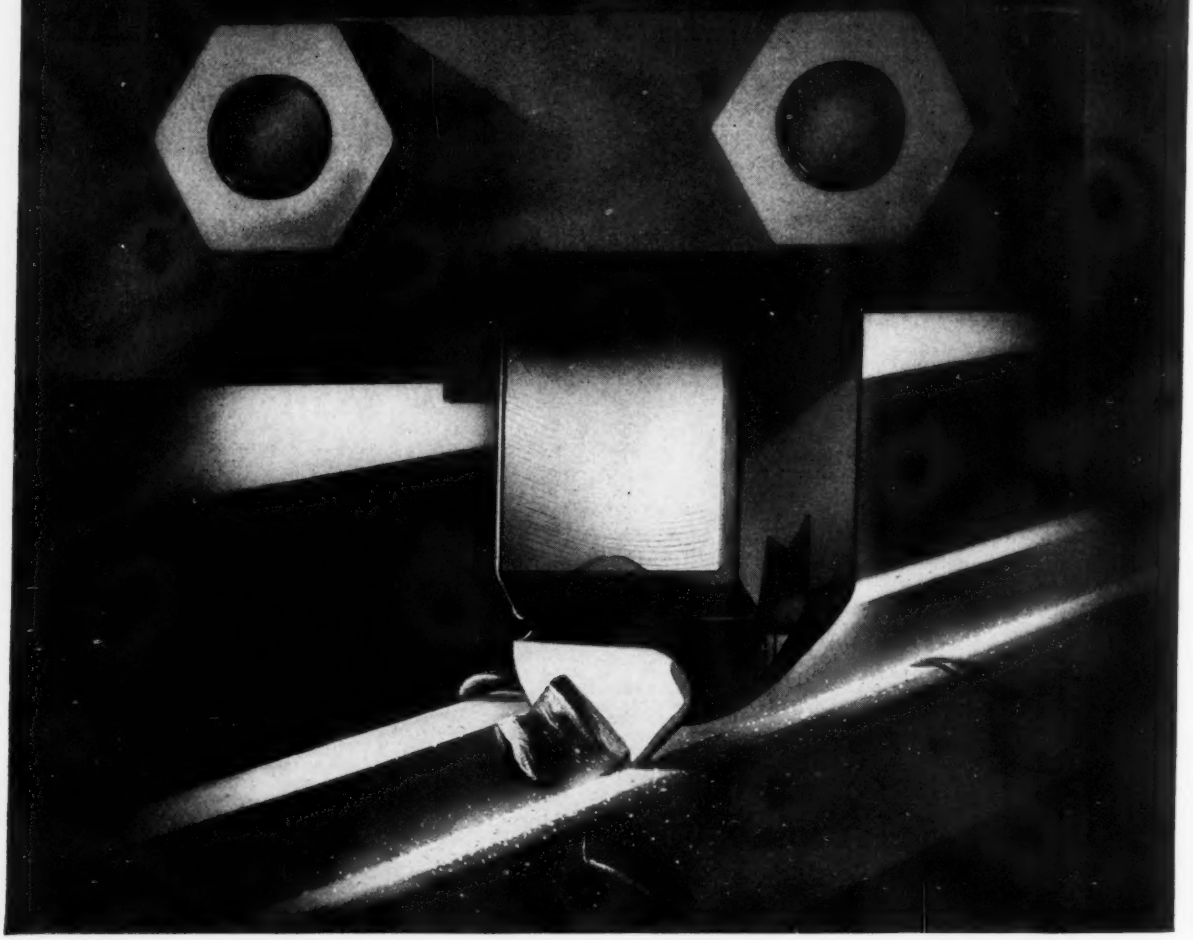

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(Continued on page 61)

Ten Men on the Ground for One in the Air

IN commercial aviation—and aside from the military—there are about ten men engaged in servicing and operations to every pilot flying aircraft. Twenty thousand people are at work on the ground to keep commercial transport planes in the air. Of United Air Lines' 3,400 personnel, for example, only 357 are members of actual flying crews.

Another trained army of technicians and workers is employed directly in aircraft production—more than 225,000 in March of this year. The figure increases daily. Additional thousands are engaged, moreover, in supplying materials, instruments and tools to the aircraft industry.

"Today more than ever," states President Wm. A. Patterson of United Air Lines, "the man who is trained for a ground job in aviation has a vital role not only in maintaining the existing standards of air transport, but also in making possible the great future development of aviation."

Technically trained men on the ground are essential to America's future in the air.

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President

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Library Accessions

(*Continued from page 31*)

The Metallography and Heat Treatment of Iron and Steel, by Albert Sauveur; 4th edition, McGraw-Hill Book Company, Inc., 1935; 531 pages.

A textbook for those seeking self-instruction in the metallography of iron and steel.

Battaglie Nel Cielo, by Silvio Scaroni; A. Mondadori, Milan, 1934; 260 pages.

An account of the experiences of an Italian pursuit flyer during the first World War.

Proceedings of the Fourth International Congress for Applied Mechanics, 1934; The University Press, Cambridge, 1935; 283 pages.

Includes general lectures and sectional papers delivered at the Congress.

Aeronautics for High Schools, Volumes I–IV, by A. Kenneth Ackerman and Ernest D. Perkins; Haaren High School Aviation Annex, New York, 1937–40; 444 pages.

A four-volume text for teaching of aeronautical subjects in high schools. The first volume provides a general introduction to the field, with sections on history, occupations in the industry, types of airplanes, etc. The second deals with construction materials and processes. Volume three concerns engines, fuels and lubricants and volume four treats in detail a miscellany of subjects, including assembly, maintenance and inspection.

Vorträge Über Motorlosen Flug, der Internationale Studienkommission für den Motorlosen Flug (Report on Motorless Flight, The International Commission for the Study of Motorless Flight); Verlag von R. Oldenbourg, Munchen, 1939; 127 pages.

A series of papers on motorless flight. Each paper is printed in full in the language of the original, and abstracts are included in English, French, German and Italian.

La Guerra Aerea, Contribucion al Estudio de la Aeronautica Militar (Air Warfare, a Contribution to the Study of Military Aeronautics), by Angel Maria Zuloaga; Libreria "El Ateneo," Buenos Aires, 1938; 267 pages.

A study of aeronautics from its beginning with special consideration of military aviation. International and national laws, regulations and agreements in reference to military aeronautics.

Ergebnisse der Aerodynamischen Versuchsanstalt zu Göttingen, IV (Research Results of the Göttingen Aeronautical Laboratory), edited by L. Prandtl and A. Betz; Verlag von R. Oldenbourg, Munchen, 1932; 147 pages.

A report on new research equipment, theoretical studies and research results derived from the Göttingen Aeronautical Laboratory.

Principles of Flight, by Edward Archibald Stalker; The Ronald Press Company, New York, 1931; 428 pages.

A college text on aeronautical engineering, this book reviews the elements of theoretical developments modern at that time.

Der Weg Voran! (The Way Onward!); edited by Hans Praesant; Verlag von Breitkopf und Haertel, Leipzig, 1931; 149 pages.

A picture-and-text story of "major German achievements." The foreword is written by Dr. Hugo Eckener. German aeronautical progress is included in the survey.

The Sky's the Limit, by D. W. Tomlinson; Macrae Smith Company, Philadelphia, 1930; 289 pages.

An autobiographical account of the writer's experiences as a pilot.

Barnard on Learning to Fly, by Capt. C. D. Barnard; The Macmillan Company, New York, 1931; 172 pages.

A well-illustrated, descriptive text on how to fly. Preface by Lieut.-Col. J. T. C. Moore Brabazon, Minister of Aircraft Production.

Annual Progress Report of Aviation Development; Florida State Planning Board, Tallahassee, 1936; 54 pages.

An over-all summary of the state of aviation progress in Florida up to 1936. Aeronautical Education, photography, airports, airway and airport marking, hangar and aircraft facilities, lighted airways and airports, radio and scheduled airlines are included in the report.

House Organs and Catalogues

(*Continued from page 36*)

Ground Direction Indicator

Azimuth Indicator for Flying Fields. H. T. Budenbom. Among the latest radio aids to airway operation developed by the Bell Laboratories is the azimuth indicating receiver for ground stations of the airway traffic control system. The new system permits the ground station to locate the direction of the approaching or departing airplane by means of an azimuth-indicating radio receiver operating on a 2 to 7 megacycle band. A comprehensive description is given of the equipment, its antenna, construction and application to the problem of simplified traffic control and increased airway safety. *Bell Laboratories Record*, November.

Aircraft Pulleys

A new section of the Westinghouse loose leaf catalogue recently issued contains information on Micarta aircraft pulleys of both the graphited sleeve bearing and anti-friction bearing types. The insert gives, besides the usual description and specifications of the products, a short sketch on the background of non-metallic material for aircraft pulleys which have been approved by the Army Air Service for over 25 years. *Westinghouse Electric & Manufacturing Co.*

Rivet Forging Machine

Bell's Better Rivets. Description of the Bell Duplex Rivet Forger, which, in a six-stage operation, makes dural rivets out of wire. The machine automatically cuts off the proper length of material, centers it over the die and progressively forms and coins the head for a perfect rivet, and then automatically ejects it from the machine. Twelve rivets move through the machine in various stages of manufacture at the same time. The Bell plant's rivet forging battery turn out over a million rivets daily. *The Bellringer*, November.

S.A.E. and A.I.S.I. Standards Compared

A booklet containing in comparative tabular form, the steel analyses of both the Society of Automotive Engineers and the American Iron and Steel Institute has been issued by *John T. Ryerson & Sons* of Chicago. It contains first, a key and explanation to the two identification systems and a comparison between them. This is followed by a comparative listing of all the commercial steels in common use, indicating their symbols in both systems. A table of average physical properties, keyed in both the A.I.S.I. and S.A.E. systems, is also included.

Training Auto Workers

They Build Bombers. An outline of the problems involved in training automobile workers to build airplane parts and sub-assemblies. Several lines of action which have been successfully applied to the problem are described. These include special training of educational executives, spare-time schooling of workers who show aptitude and part-time work on dummy airframes. Full cooperation with local educational institutions has also produced many craftsmen who learn theory and primary practice in school and get intermediate education and actual shop practice in the plants. *Automobile Facts*, November.

Aircraft Finishes

A third edition of the *Titanine* aircraft finish catalogue and instruction book has been issued by International Paints, Ltd. of Montreal. The file-size brochure contains in 23 pages a brief history of doped aircraft finishes as well as a technical description of the currently used dopes, thinners, anti-blush solutions, fillers, levelers, primers and pigments. Detailed directions are given for the use of the various products, and hints on doping and dope room practice are provided. *International Paints, Ltd.*, Montreal.

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(*Continued from page 59*)

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Why Instruments Seem to Fail in Fog, by William C. Ocker; *Aeronautic Review*, November 1928, page 174.

Prevention of Corrosion in Instruments, by William Nelson; *Aviation*, October 20, 1928, pages 1260, 1276, 1278.

Quelques Instruments Nouveaux; *L'Aerophile*, September 1–15, 1928, page 283.

Modern Developments in Aircraft Instruments, by C. J. Stewart; *Journal of the R. Ae. S.*, June 1928, pages 425–481.

Airplane Instruments; *Popular Aviation*, December 1927, pages 43, 44, 64.

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Non-Metallic Diaphragms for Instruments, by H. N. Eaton and C. T. Buckingham; Washington, U.S. Govt. Print. Off., 1925, 24 pages. (*N.A.C.A. Report* No. 206.)

Les Instruments de Controle pour la Locomotion Aerienne; *L'Aerophile*, December 1–15, 1924, page 391.

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Aerial Navigation and Navigating Instruments, by H. N. Eaton; Washington, U.S. Govt. Print. Off., 1922, 44 pages. (*N.A.C.A. Report* No. 131.)

Aeronautic Instruments; Recent Developments and Outstanding Problems, by F. L. Hunt; Washington, U.S. Govt. Print. Off., 1922, 14 pages. (*N.A.C.A. Report* No. 132.)

Flugzeuginstrumente, by Kurt Bennewitz; Berlin, R. C. Schmidt & Company, 1922, 324 pages.

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Repair and Calibration of Airplane Instruments; Washington, U.S. Govt. Print. Off., 1920, 19 pages. (*War Department Document* No. 925.)

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Aeronautical Instruments, by Arthur W. Judge; In *Handbook of Modern Aeronautics*; New York, D. Appleton Company, 1919, pages 680–710.

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The Pilot's Office; Instruments for Air Use, by William A. Robson; *Flight*, August 15, 1918, page 911.

General Specifications for Aeronautic Instruments; Washington, U.S. Govt. Print. Off., 1916, 6 pages. (*N.A.C.A. Report* No. 8.)

News Review

(*Continued from page 6*)

sion will replace an Italian group whose contract was recently rescinded.

November 7. A Consolidated Catalina flying boat, being delivered from San Diego to Sidney, Australia, established what is believed to be a long-distance record for that type of aircraft when it flew non-stop from Canton Island to Sidney, a distance of 3,300 miles.

November 8. The newspaper *La Stampa* of Turin carried a story stating that Roald Amundsen, given up as dead since 1928, was found alive among the fjords of the North Baffin Sea. Amundsen and five companions were lost attempting to locate survivors of the Italian dirigible, *Italia*.

November 9 The world's largest flying boat, the 200-ft. four-engined Martin patrol-bomber was launched at Middle River, Maryland.

November 9. The U.S. Naval post in Iceland was elevated to a major Naval Base. It will be commanded by Rear Admiral James L. Kauffman.

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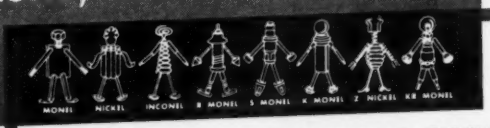

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		Hot-rolled	90	50	35	150	110
		Cold-drawn	100	80	25	190	95
		Cold-rolled, hard-temper	110	100	5	240	
"R" MONEL* Contains the addition of .035% sulfur—	FREE CUTTING For High Speed Machining.	Hot-rolled	85	45	35	145	96
		Cold-drawn	90	75	25	180	99
"K" MONEL* Contains the addition of 2.75% Aluminum	EXTRA STRENGTH AND HARDNESS comparable to heat treated alloy steel. Heat Treatable. Non-magnetic.	Hot-rolled, As-rolled	100	45	40	160	120+
		Hot-rolled, Heat-treated	150	110	25	280	40
		Cold-drawn, As-drawn	115	85	25	210	56
		Cold-drawn, Heat-treated	155	115	20	290	26
"KR" MONEL*	FREE CUTTING Extra Strength and Hardness. Heat Treatable. Non-magnetic.	Hot-rolled, As-rolled	105	65	40	185	
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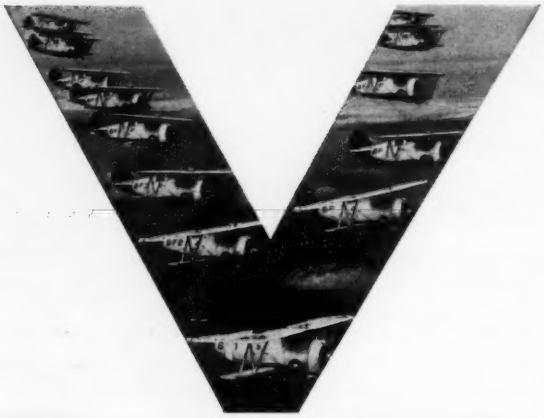

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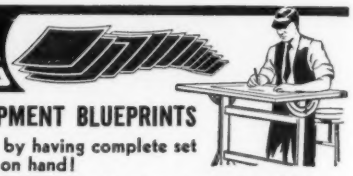

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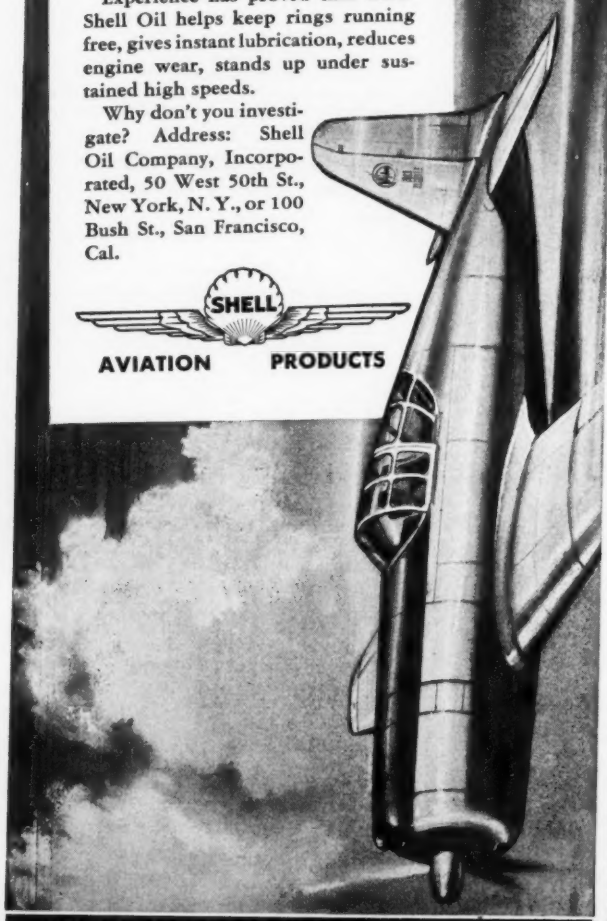

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Periodicals

(*Continued from page 21*)

They Wear the Pants. W. Gerard Tuttle. The industrial relations director of Vultee Aircraft, Inc., gives an account of the extensive employment of women in the Vultee plant to relieve the employment shortage. The variety of jobs to which they have proved adaptable and in which they have demonstrated proficiency are described, along with the hiring and training system for fitting them to important production operations all the way from unit fabrication to final assembly. *Aviation*, November 1941, pages 54, 55, 182, 186, 9 illus.

Aviation's Tax Hurdle. Selig Altschul. An examination of the effect of present taxation upon the aviation industry and its defense effort. It is stated that while the battle of production is going on and being licked, taxes are slated to become a far more important factor in the affairs of the aircraft group than previously imagined. The writer analyzes this situation and gives the reasoning behind his conclusions. *Aviation*, November 1941, pages 99, 158.

Motores Livianos (Lightplane Engines). Description of the AVA 4 A-00 opposed type four-cylinder 65-hp. engine for sportplanes built by La Campagnia Nazionale Aeronautica of Rome. *Aeronautica*, July 1941, page 47, 2 illus.

Canon Cargado Con Aviones (A Cannon which Shoots Airplanes into Space). A study of the catapulting of airplanes. The physiological effects on the pilot are described. *Aeronautica*, September 1941, page 31.

Varende Vliegvelden (Mobile Flying Fields). Eric Janssen. While on a visit to the United States, the writer, a newspaperman, stayed aboard the aircraft carrier *Wasp* during a practice run. This article describes his view of the life and activities aboard the naval vessel. *Vliegwereld*, August 14, 1941, pages 442, 443, 3 illus.

Los Turcos y La Aviacion (The Turks and Aviation). William Gilman. A travelogue on modern Turkey with special emphasis on the development of military aviation in that country. *Alas*, May 1941, pages 14–17, 2 illus.

War Artists' Exhibition. A review of the War Artists' Exhibition at the National Gallery, two rooms of which were recently opened to the public. The R.A.F. is well represented and some of the works show impressions of aerial warfare. Portraits by Eric Kennington are particularly praised. *Flight*, October 9, page 243, 3 illus.

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